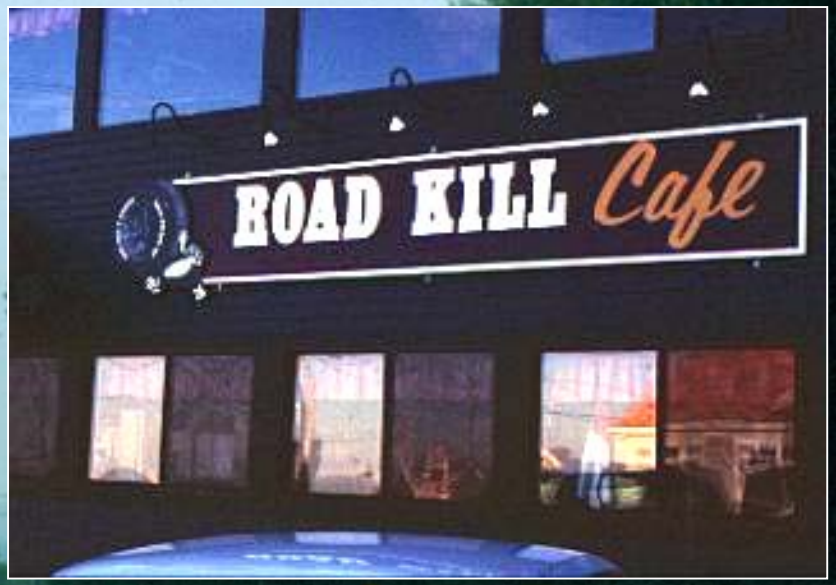
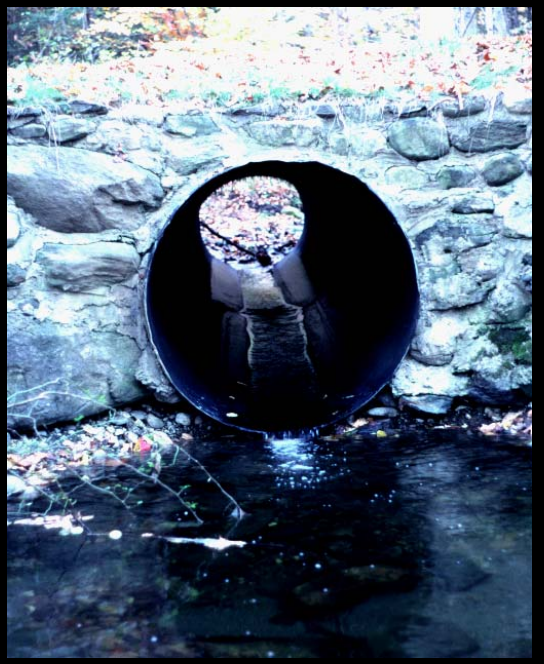
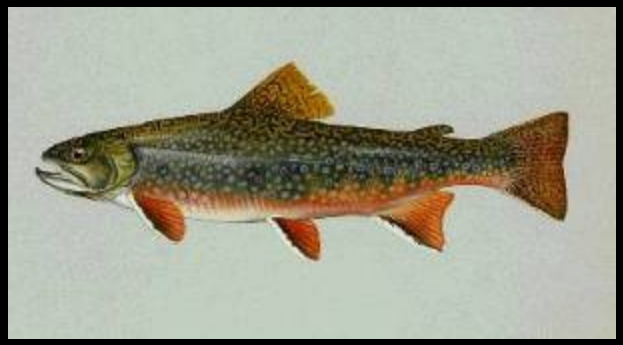


Beyond Roadkill: Mitigating Road and Highway Impacts on Wildlife

Sub-standard Culverts




Micrographia

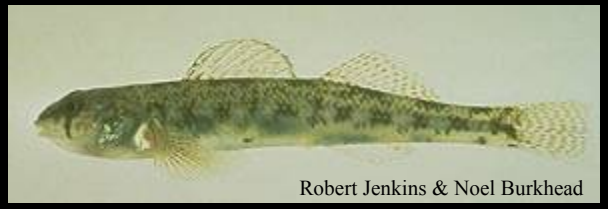



Alan Richmond


Micrographia


© 1999 Joyce Gross


Barry Wicklow


Robert Jenkins & Noel Burkhead

Highways: Wildlife Impacts

- Habitat loss and degradation
- Habitat fragmentation
- Road avoidance/human exploitation
- Reduced access to vital habitats
- Roadkill leading to loss of populations
- Population fragmentation & isolation
- Disruption of processes that maintain regional populations
- Alteration of ecological processes


WILDLIFE
CROSSING


THREATENED
BURROWING OWLS
AHEAD
PLEASE DRIVE
CAREFULLY!


ATTENTION
Wildlife
on road
Animaux
sur la route

Signs


NEXT 4 km


Next 92 km


Maryland
WILDLIFE
WATCH FOR IT!
STAY ALERT


AP / Nina Greipel

Reduced Access to Vital Habitats

- Summer and winter ranges
- Mineral licks
- Amphibian wetland breeding sites
- Upland turtle nesting areas
- Snake hibernacula

Reduced Access to Vital Habitats: Rivers & Streams

- Spawning habitat
- Nursery habitat
- Foraging areas
- Deep water refuges
- Seasonal habitats

Population Fragmentation and Isolation

- Barriers to movement subdivide or isolate populations
- Smaller and more isolated populations are more vulnerable to:
  - extinction due to chance events
  - genetic changes

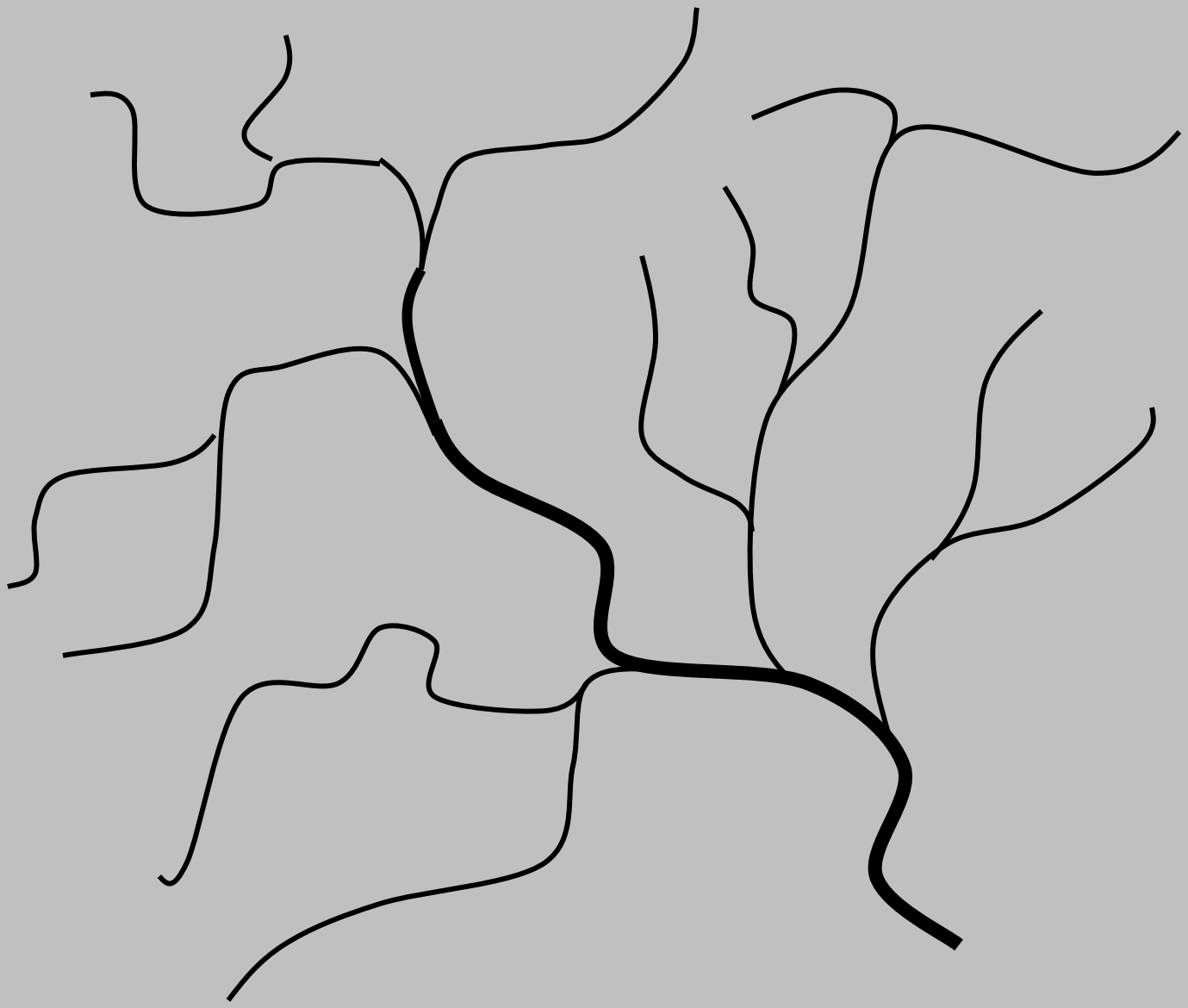
Population Viability

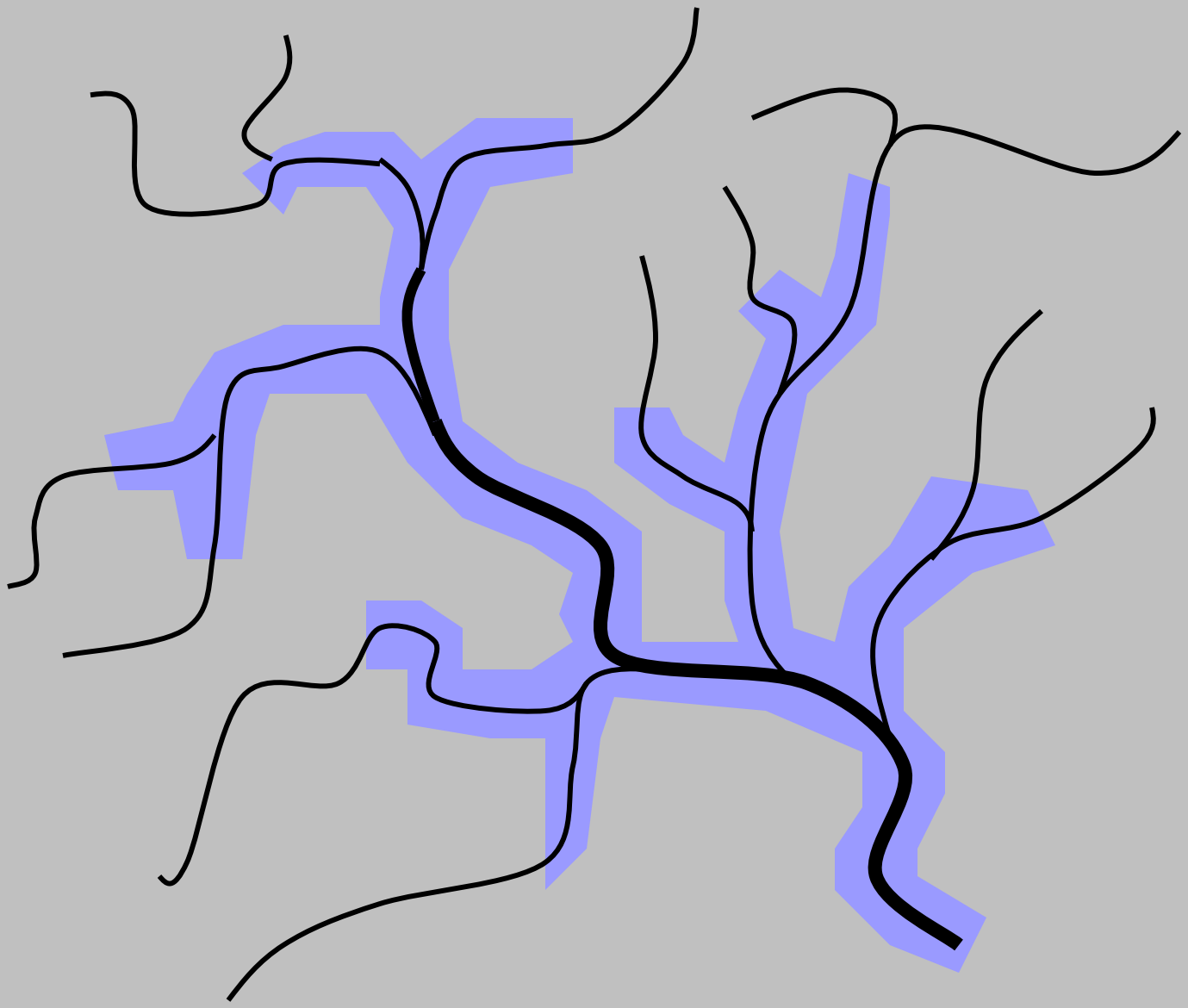
Short-term viability

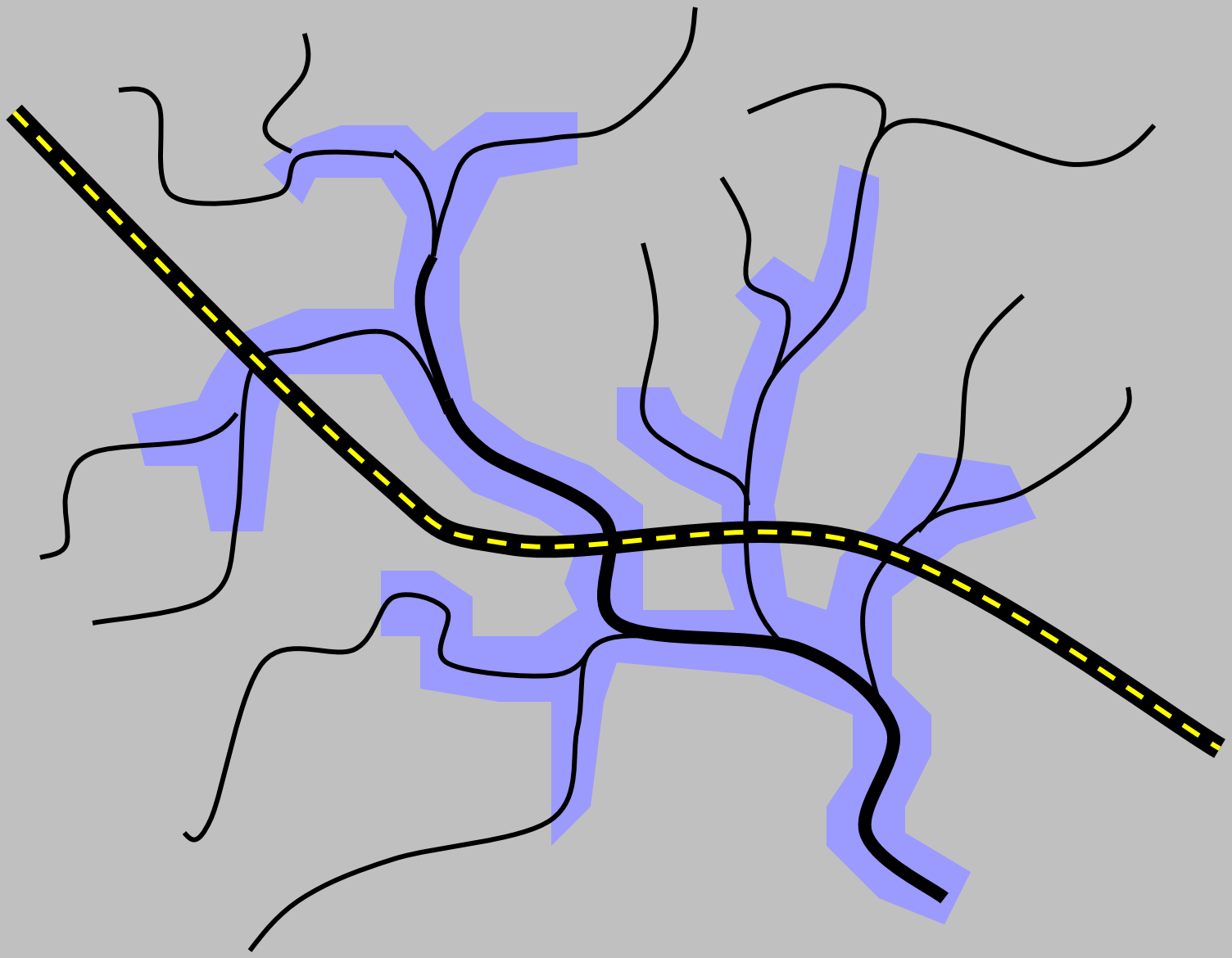
$N_e = 50$ to $200+$

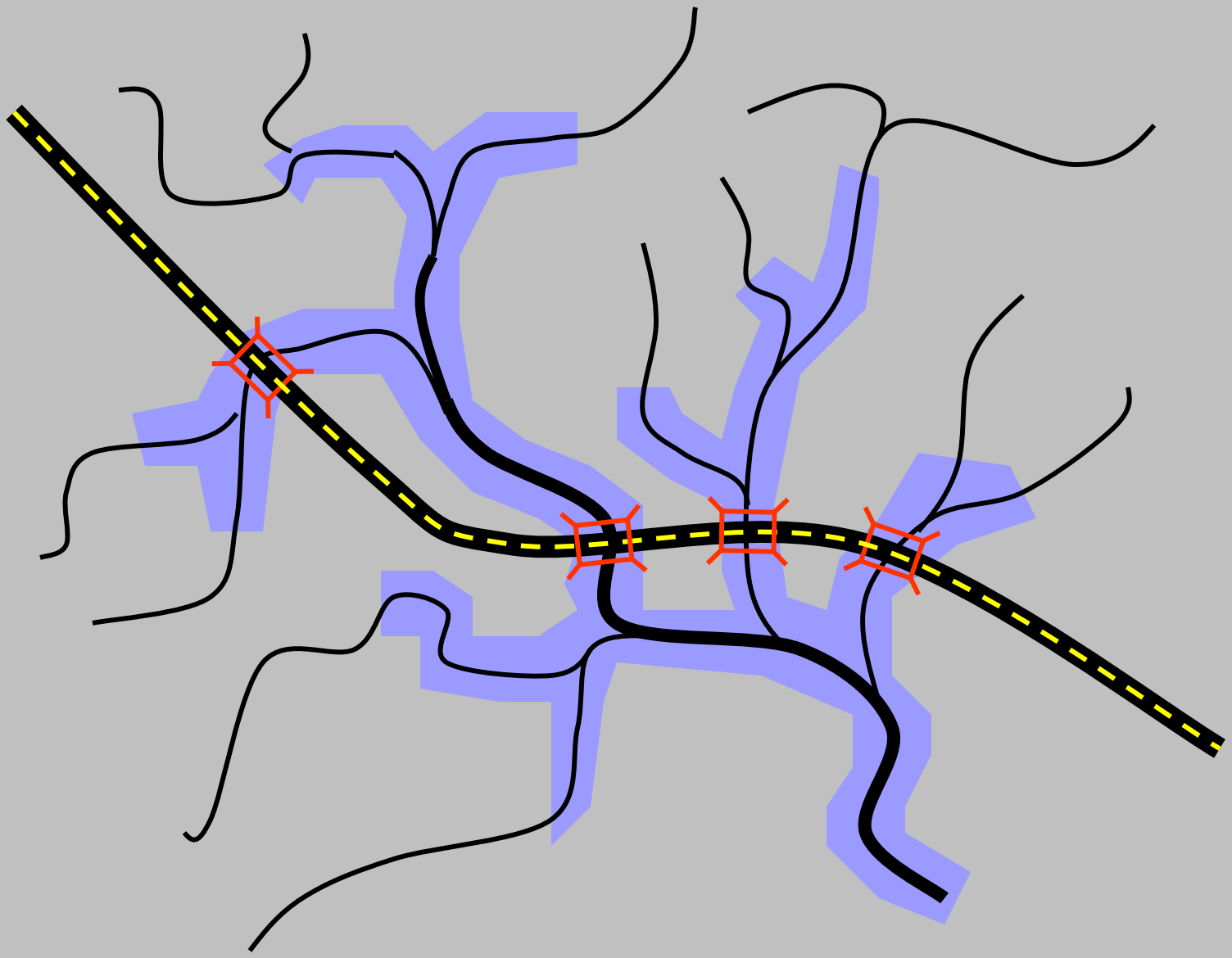
Long-term viability

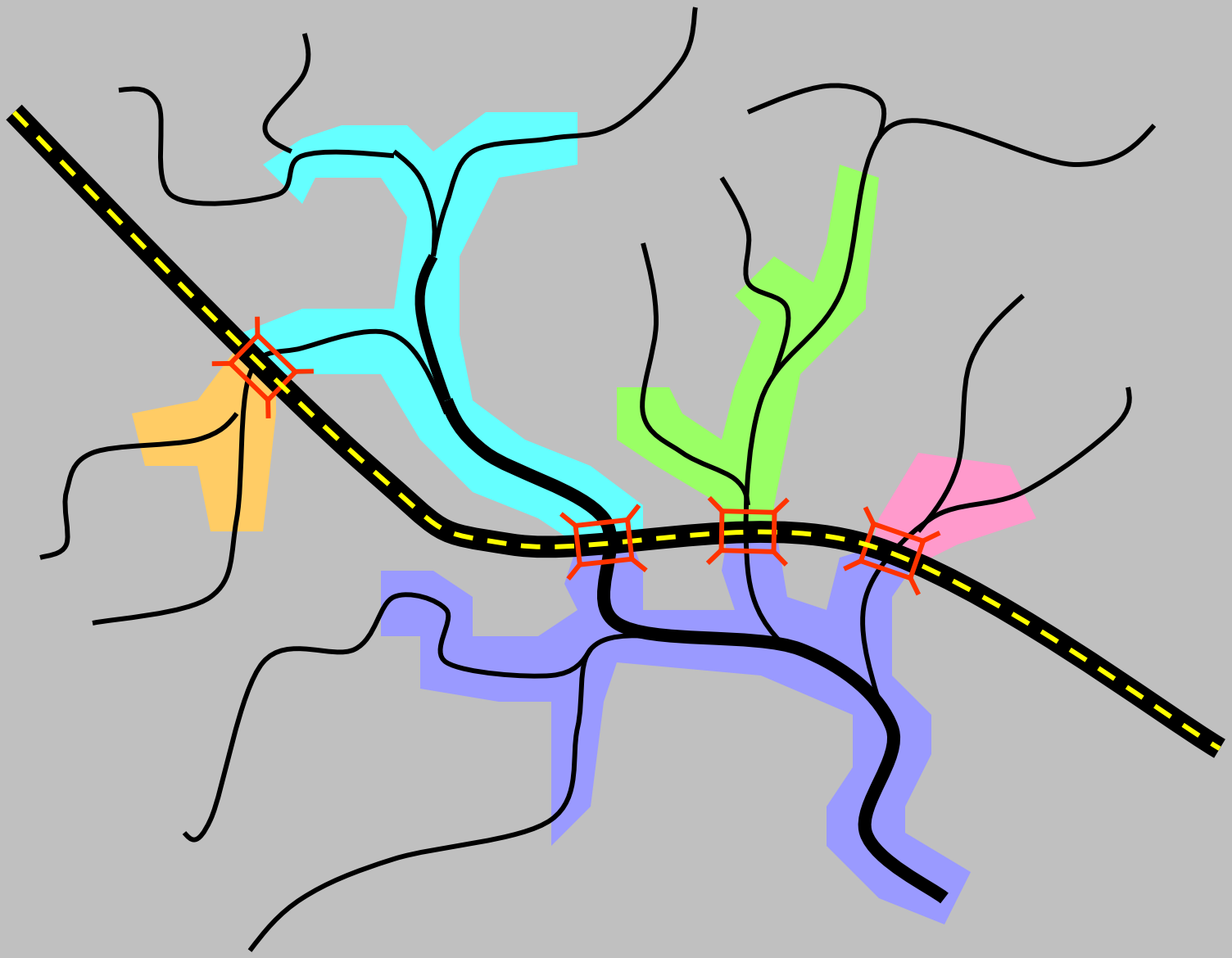
$N_e = 500$ to $5000+$

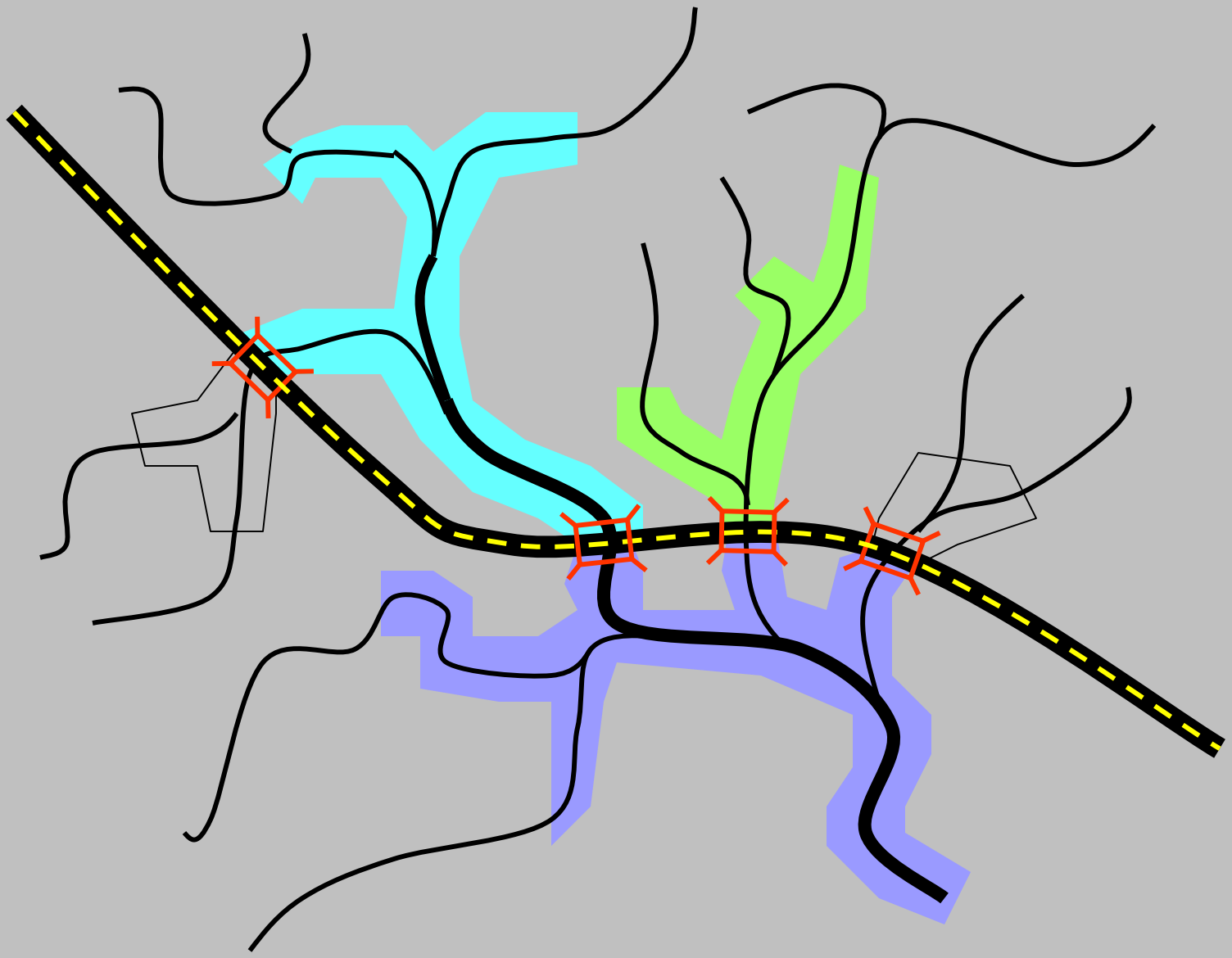


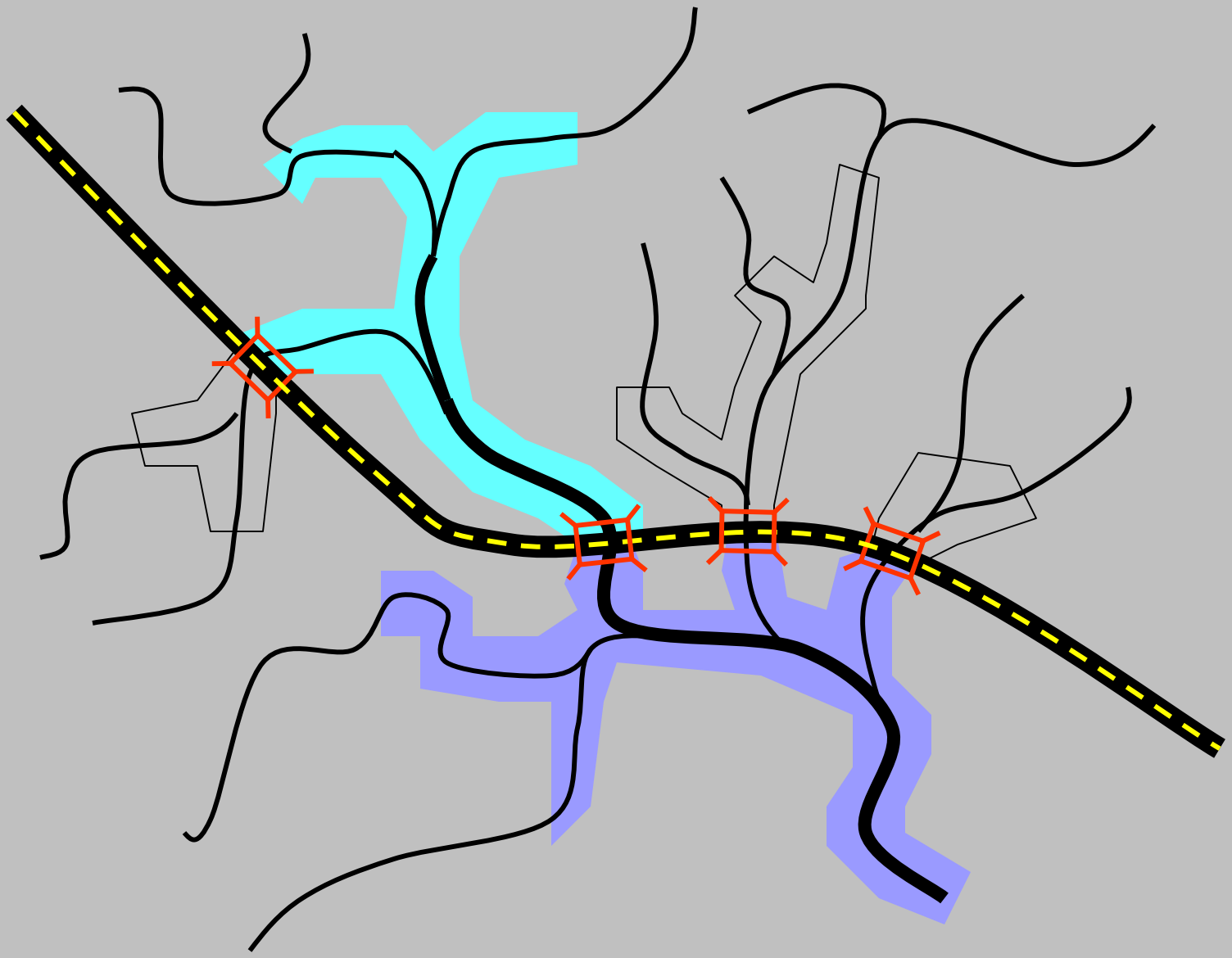




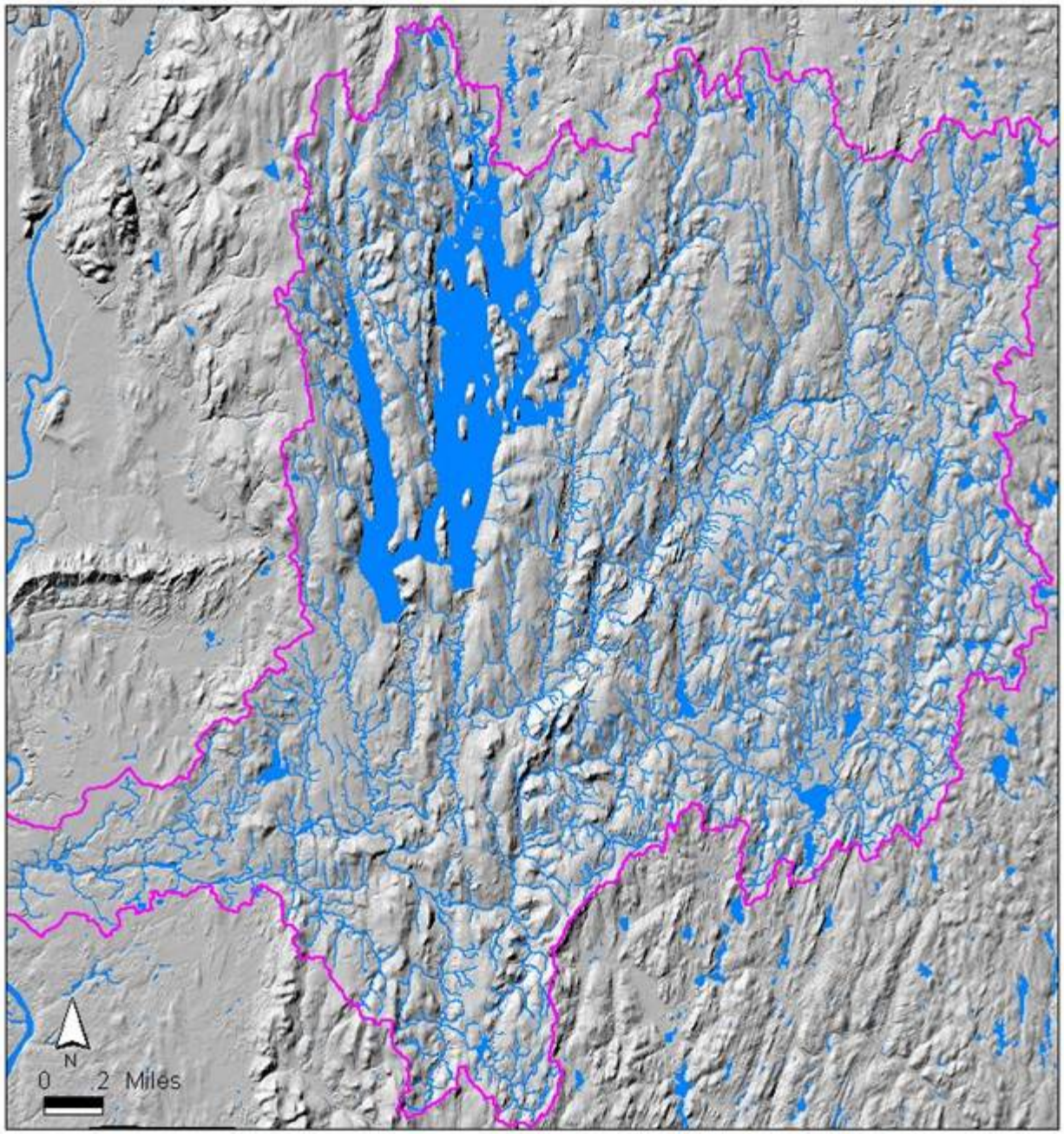








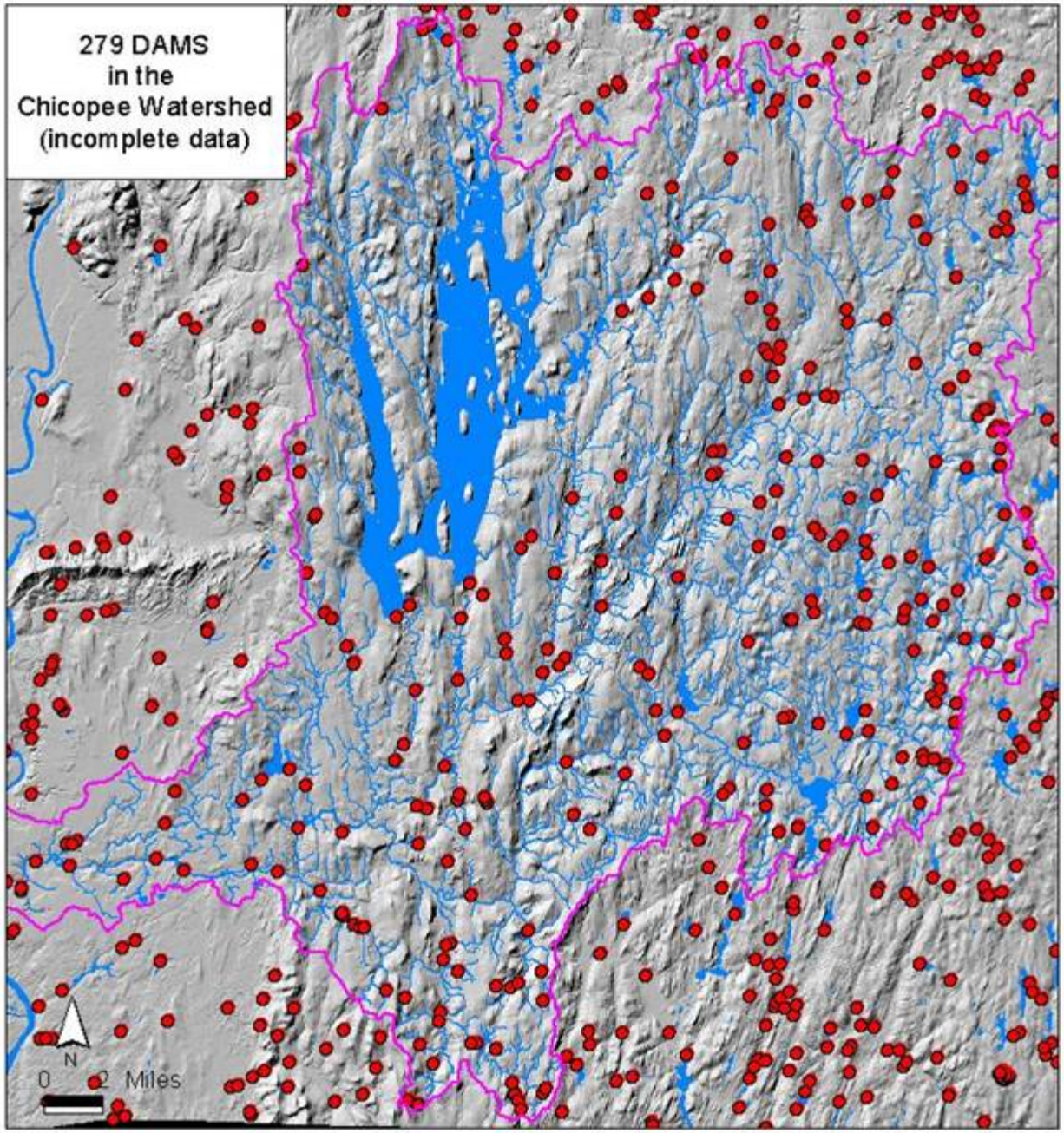
CHICOPEE WATERSHED



721 sq.mi.

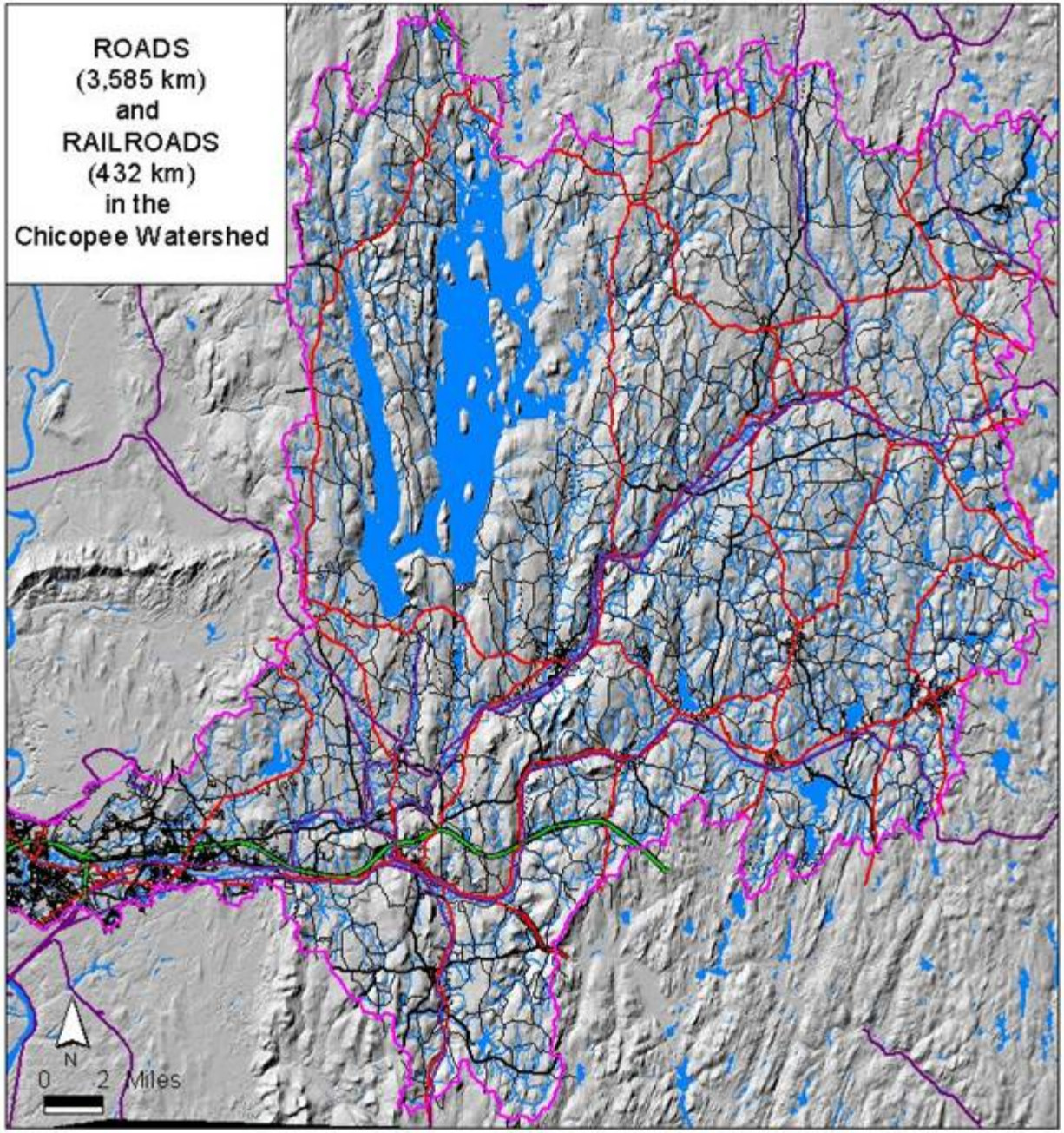
Source:
MA Riverways Program

CHICOPEE WATERSHED



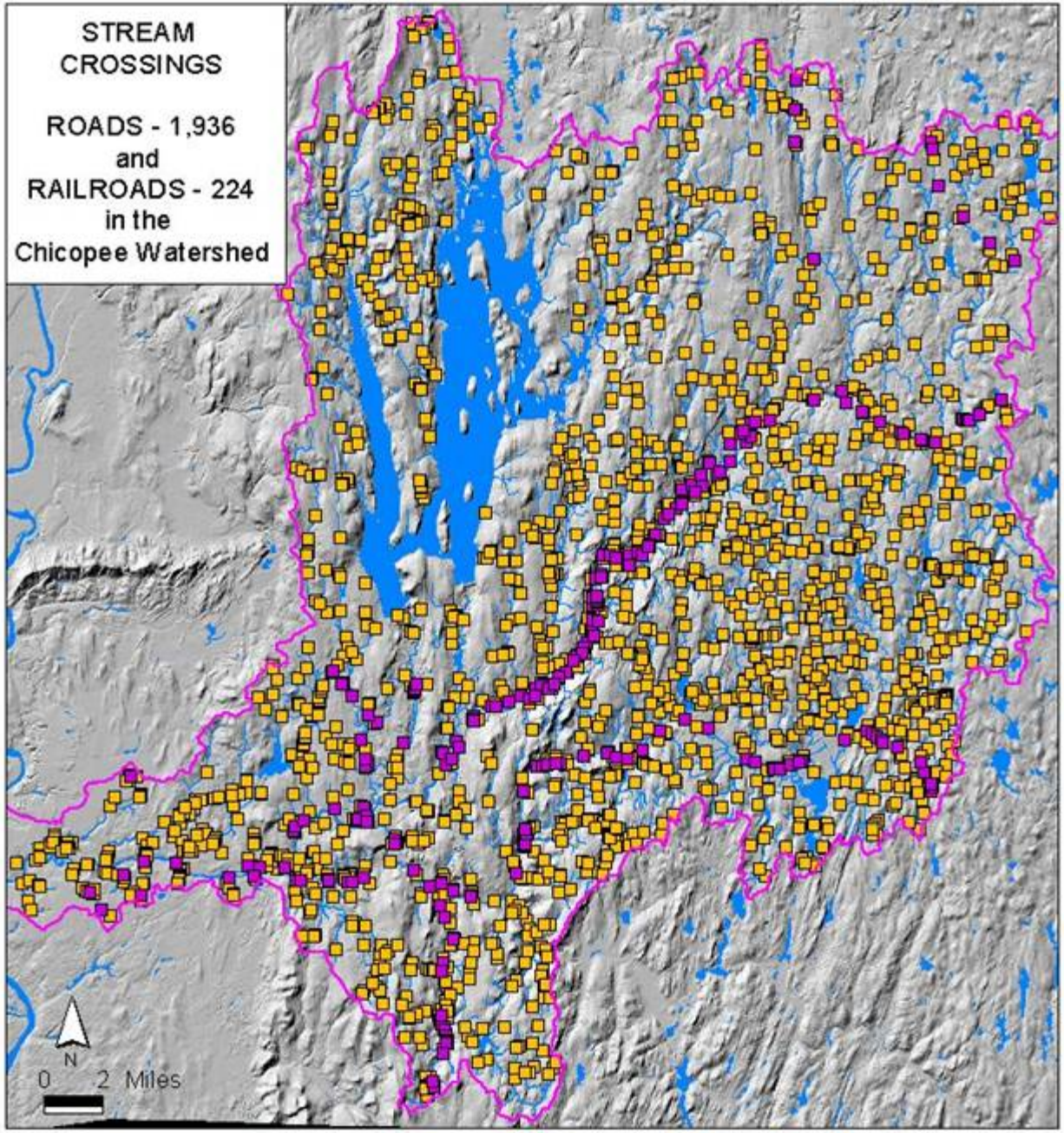
Source:
MA Riverways
Program

CHICOPEE WATERSHED



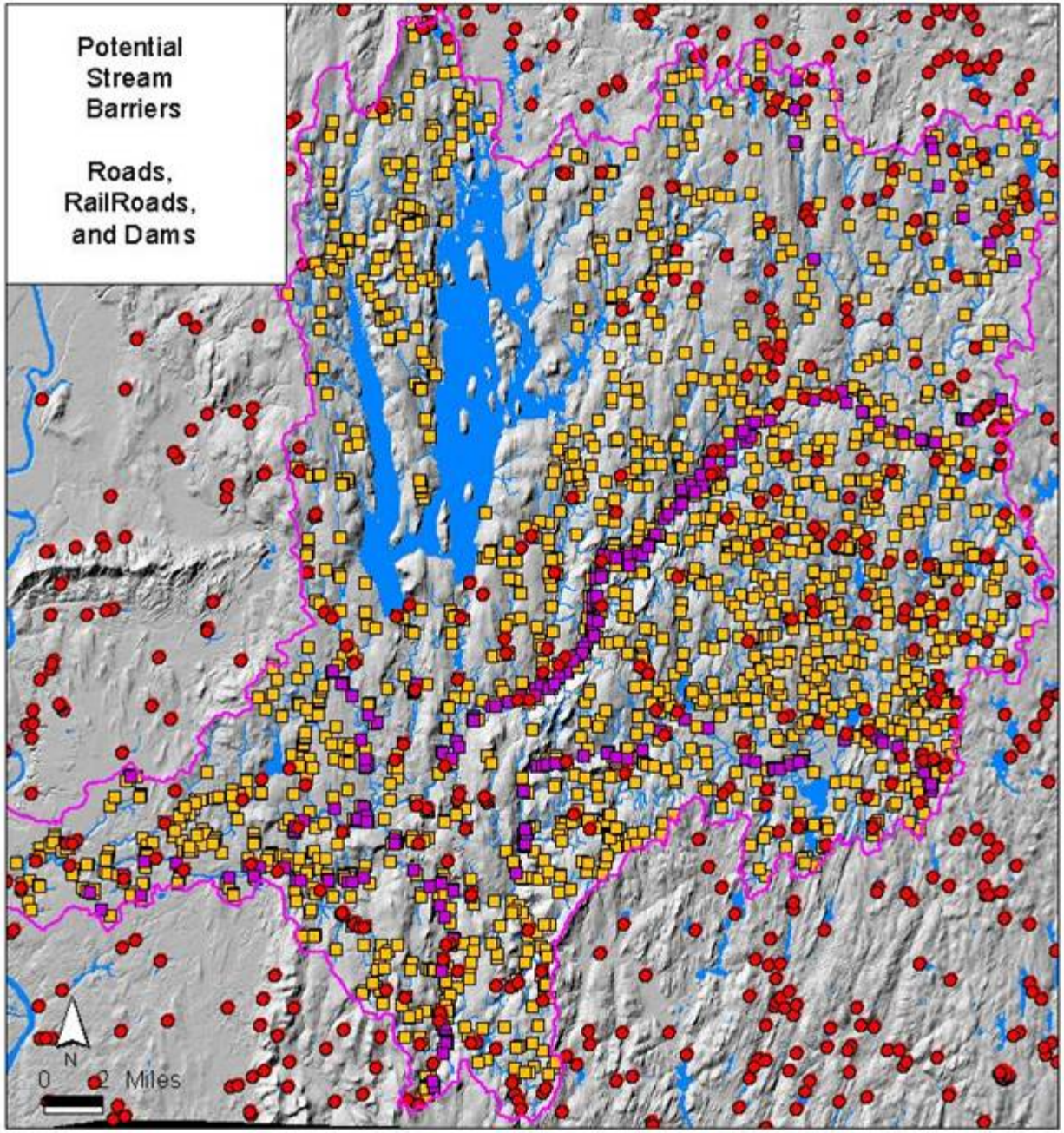
Source:
MA Riverways
Program

CHICOPEE WATERSHED



Source:
MA Riverways
Program

CHICOPEE WATERSHED

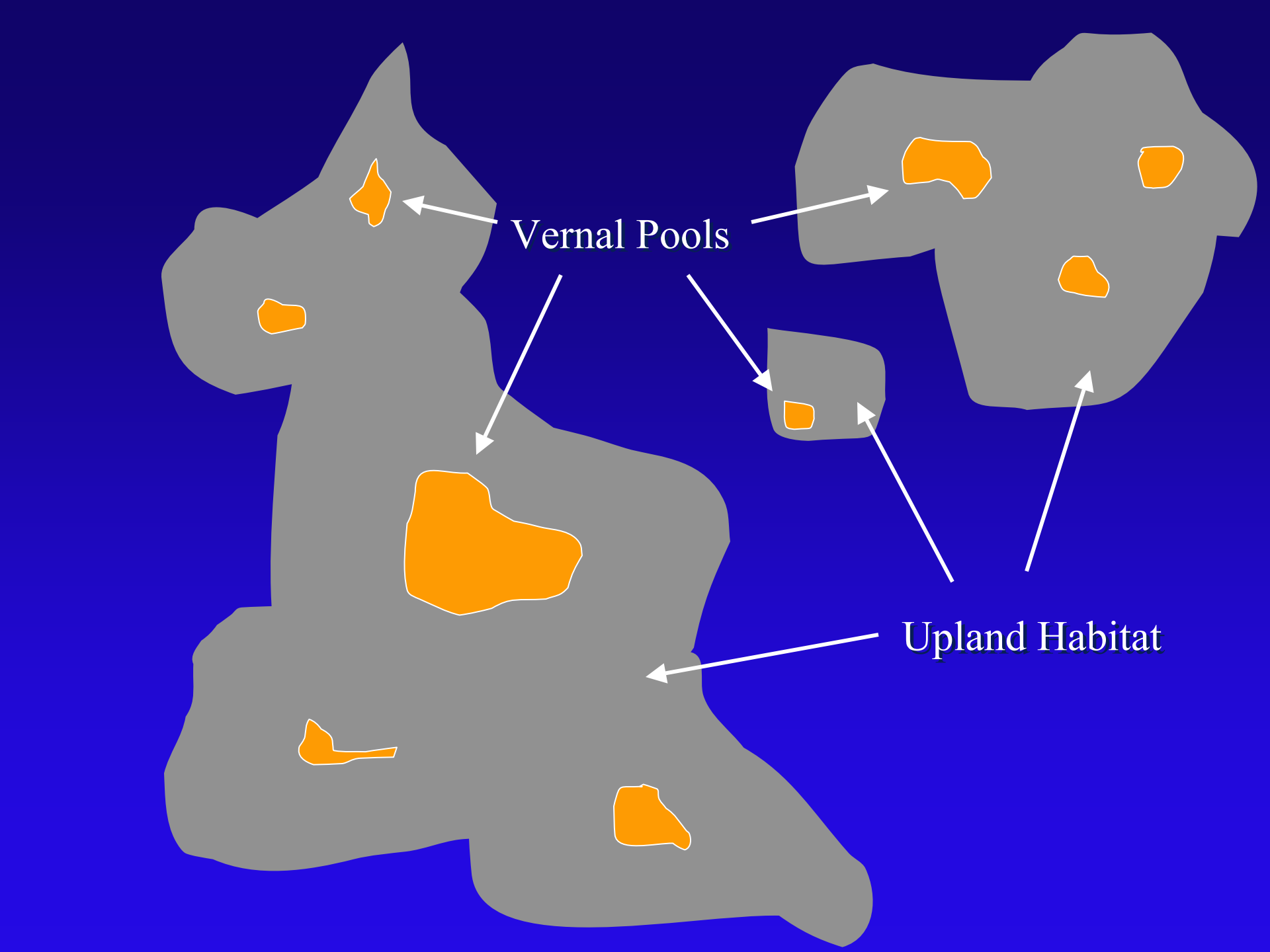


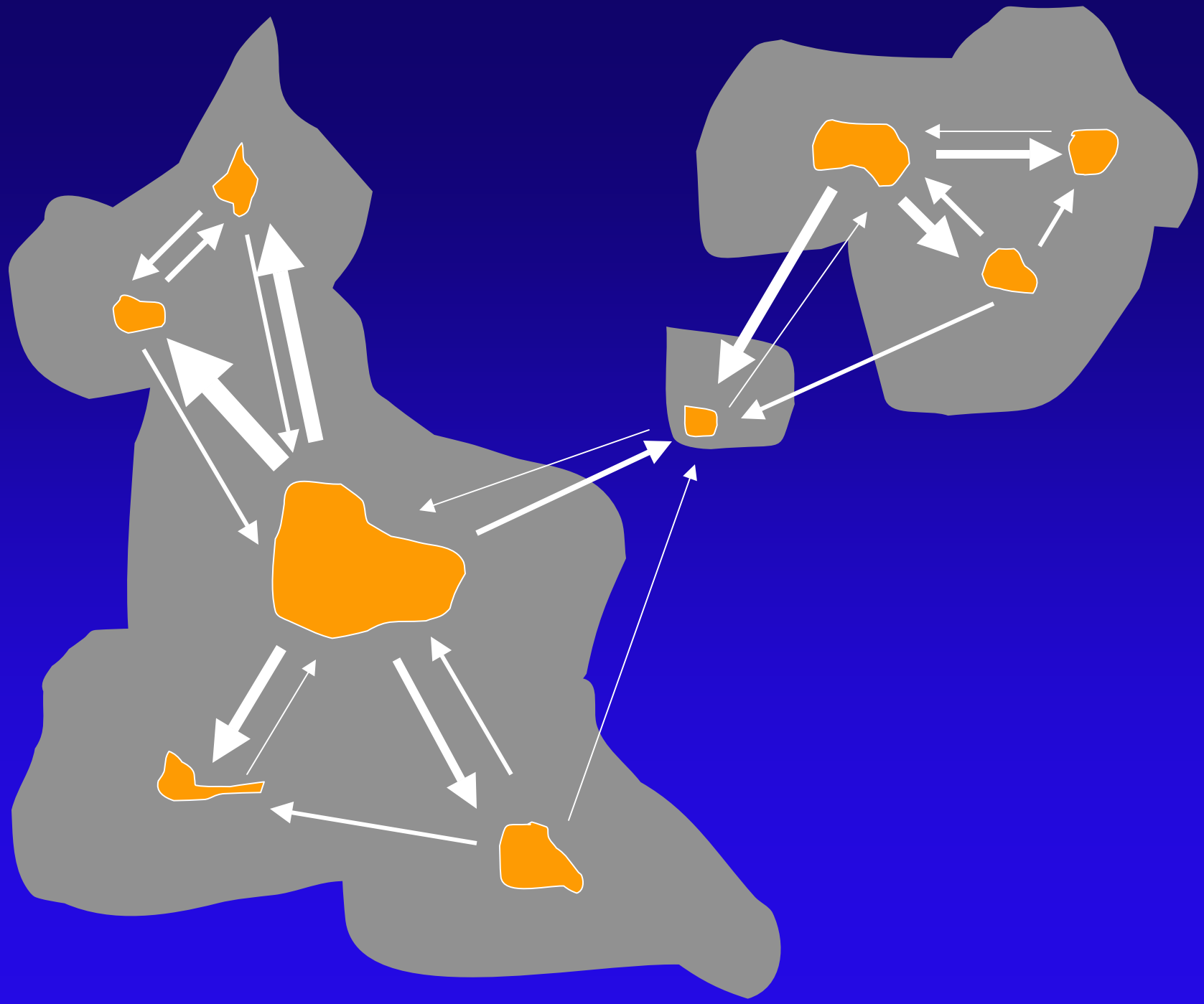
Source:
MA Riverways
Program

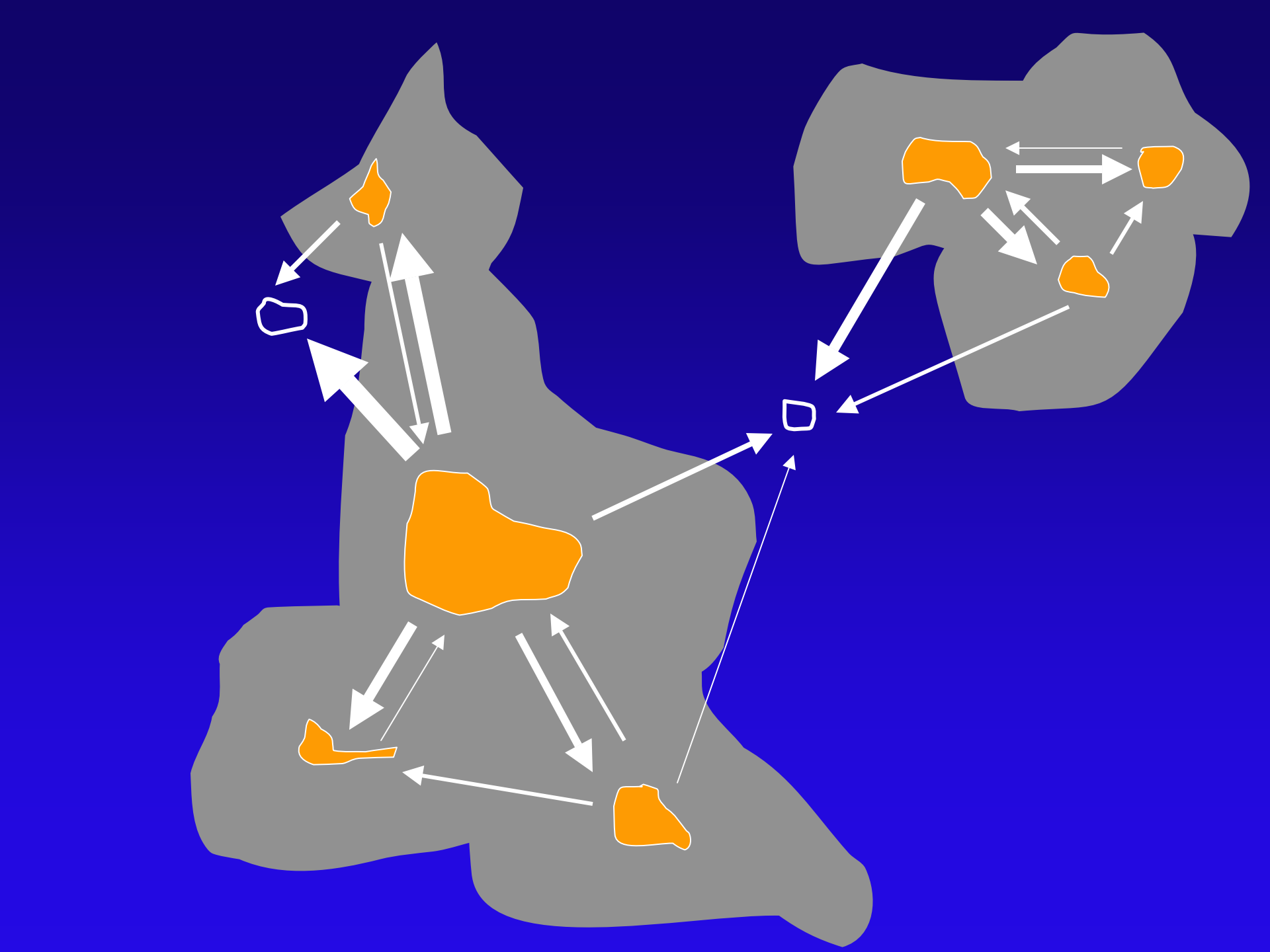
Processes that Maintain Regional Populations ("Metapopulations")

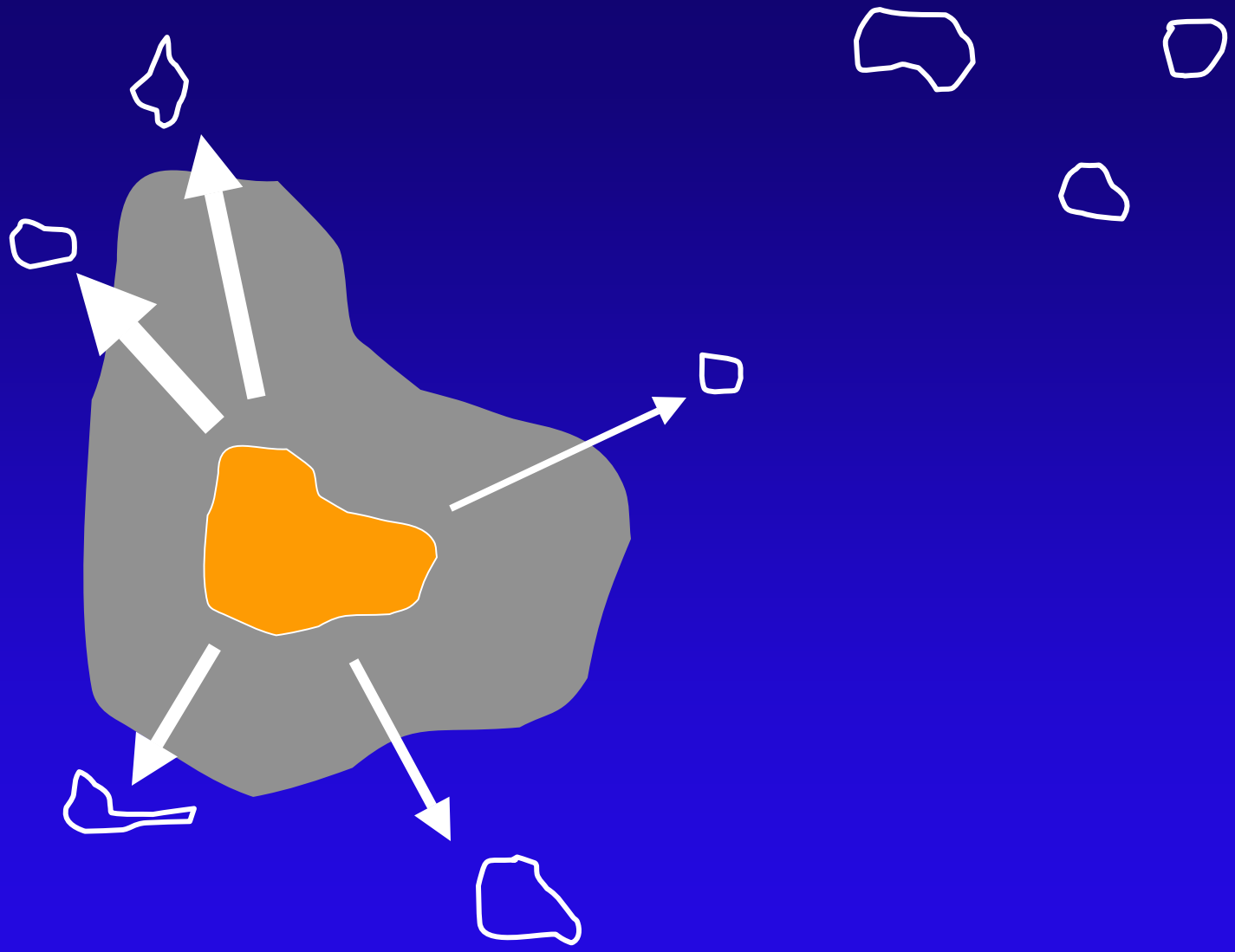
- Gene flow
- Supplementation ("rescue effect")
- Re-colonization

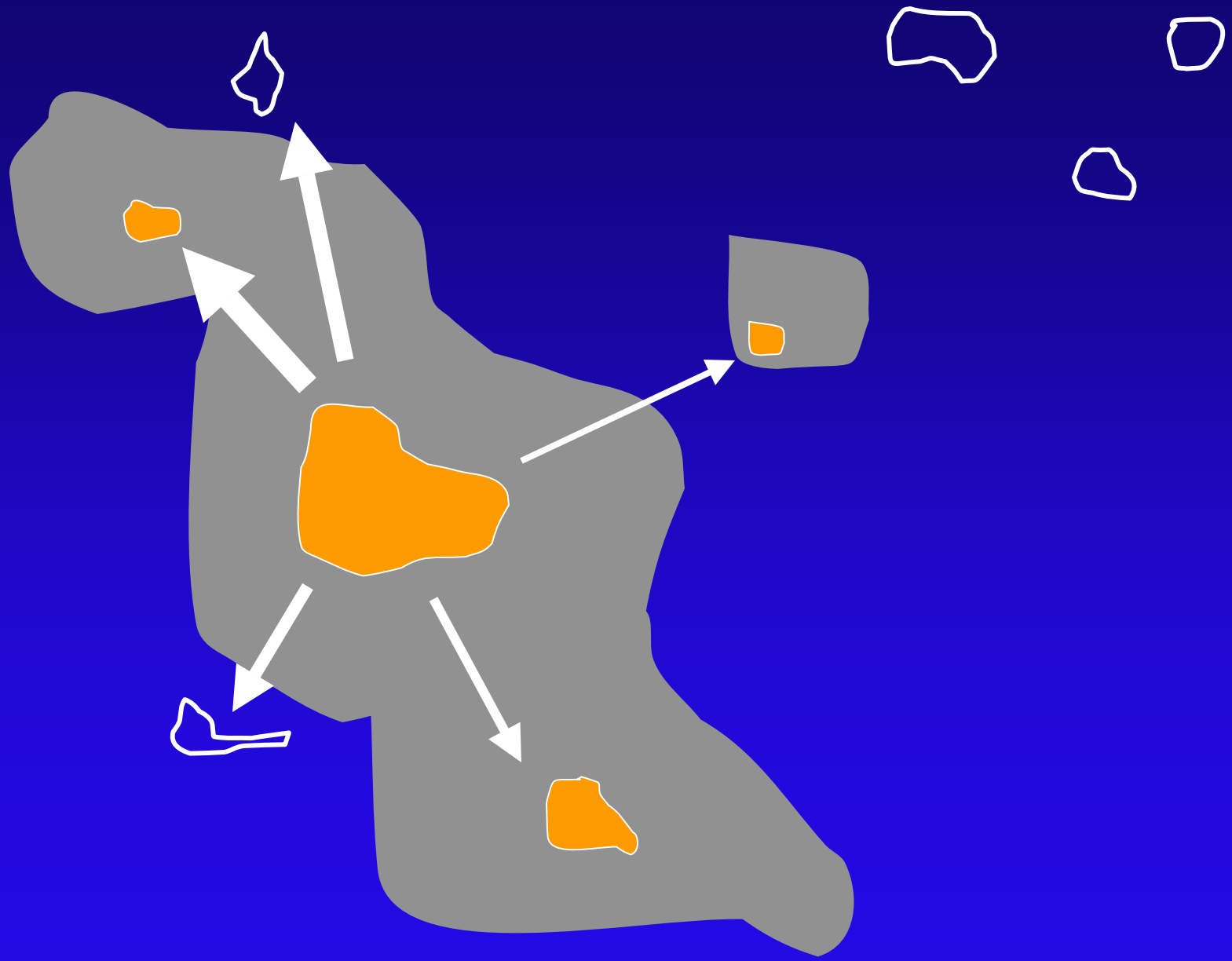
Vernal Pools

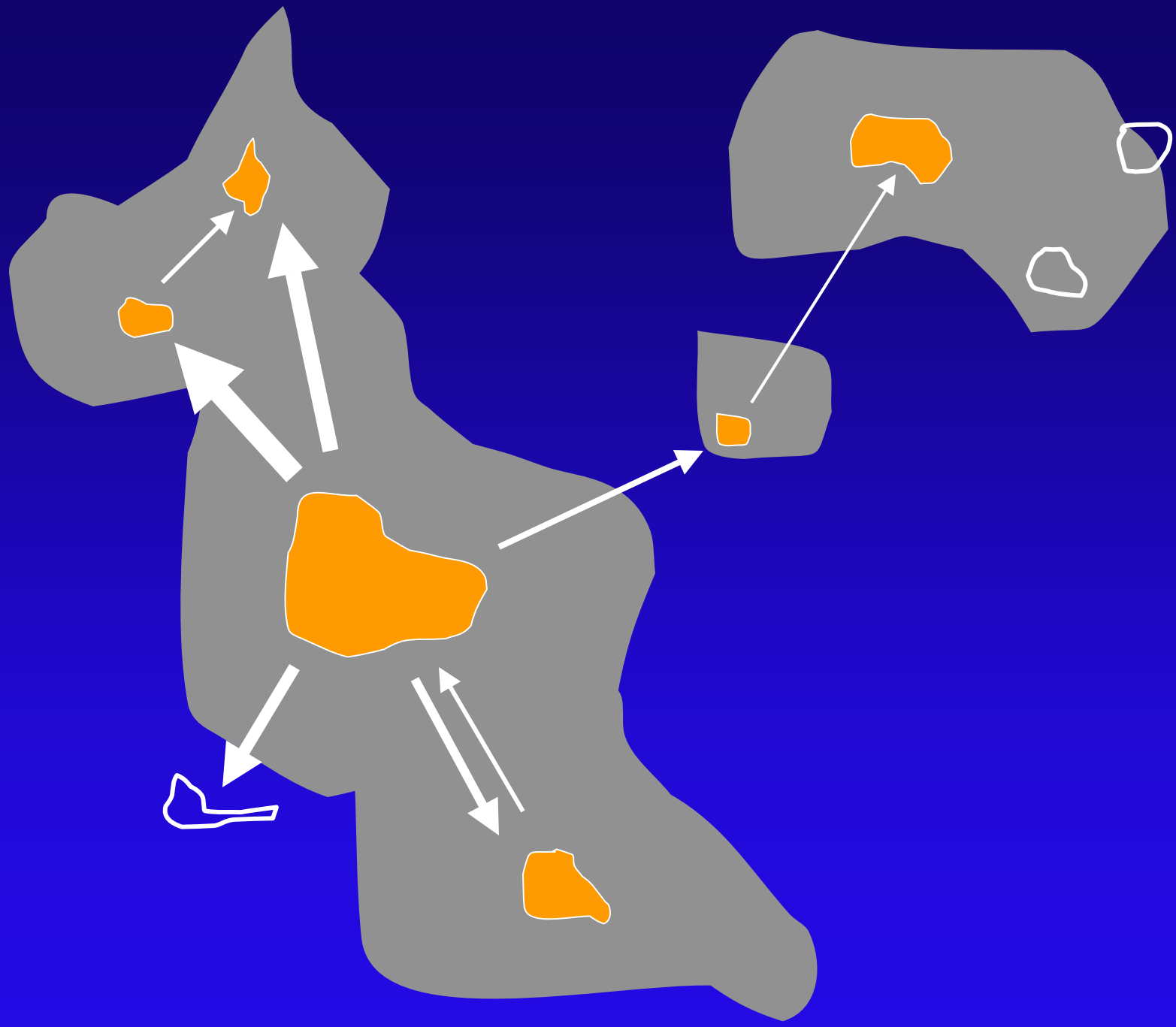

Vernal Pools
Upland Habitat

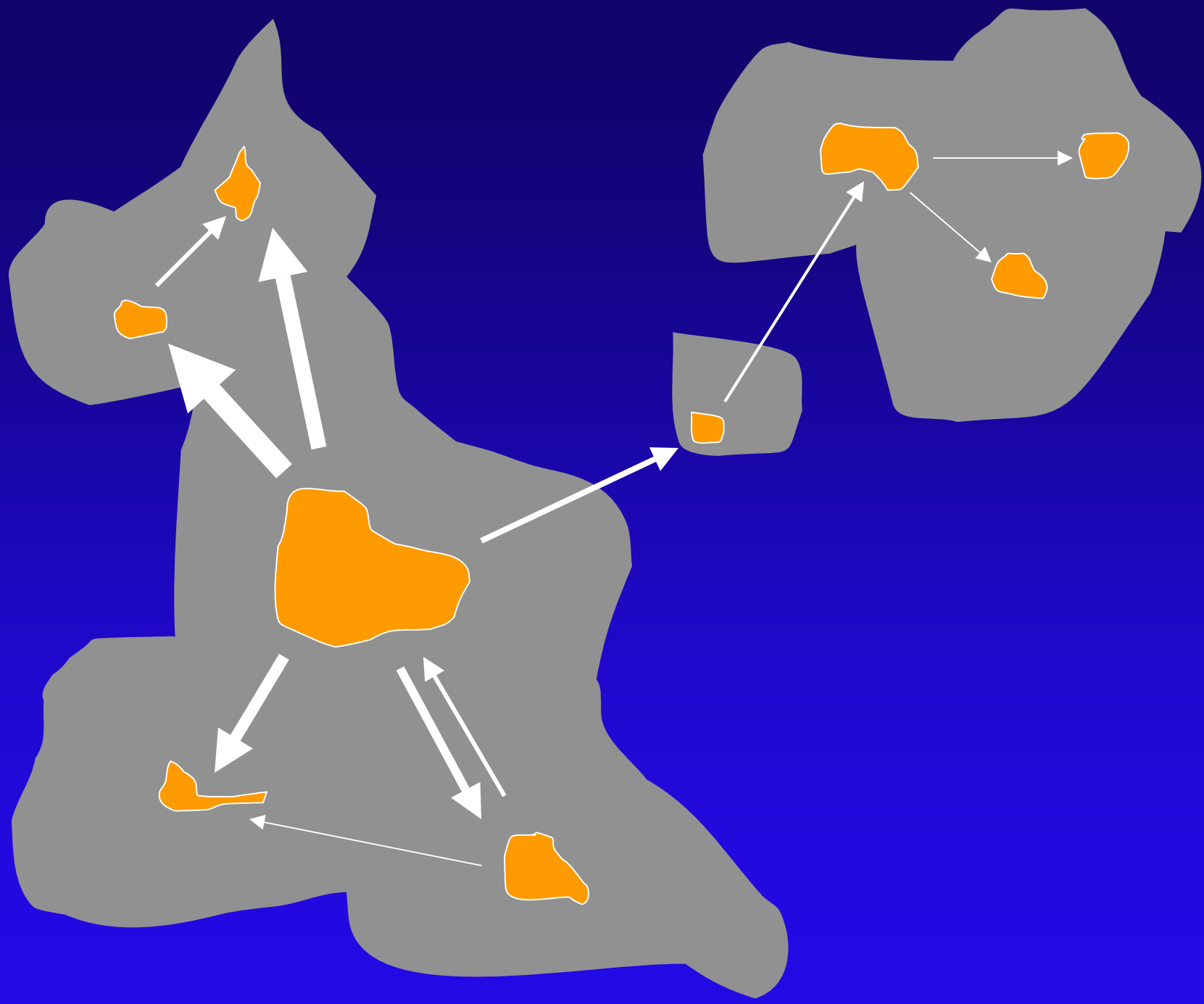


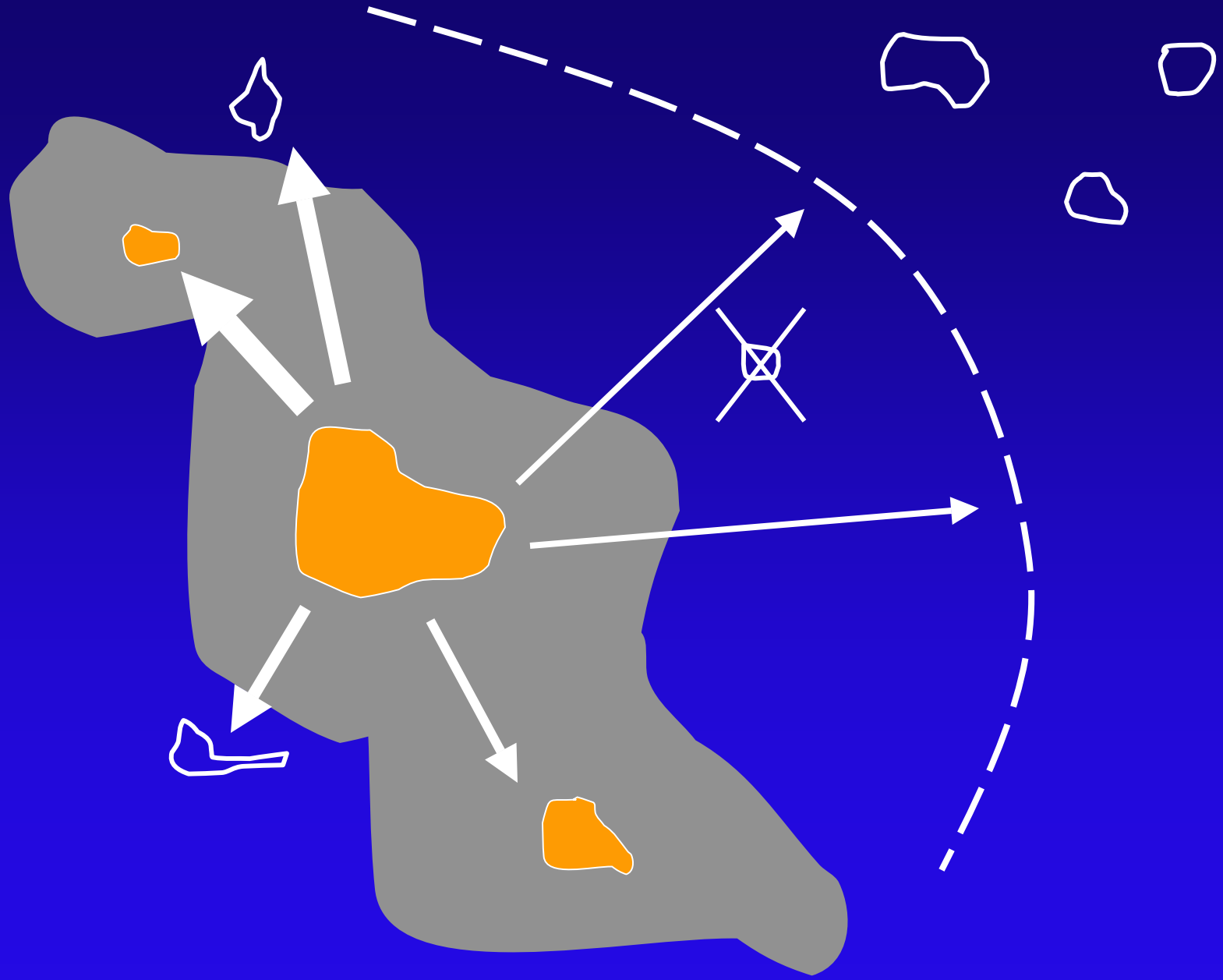


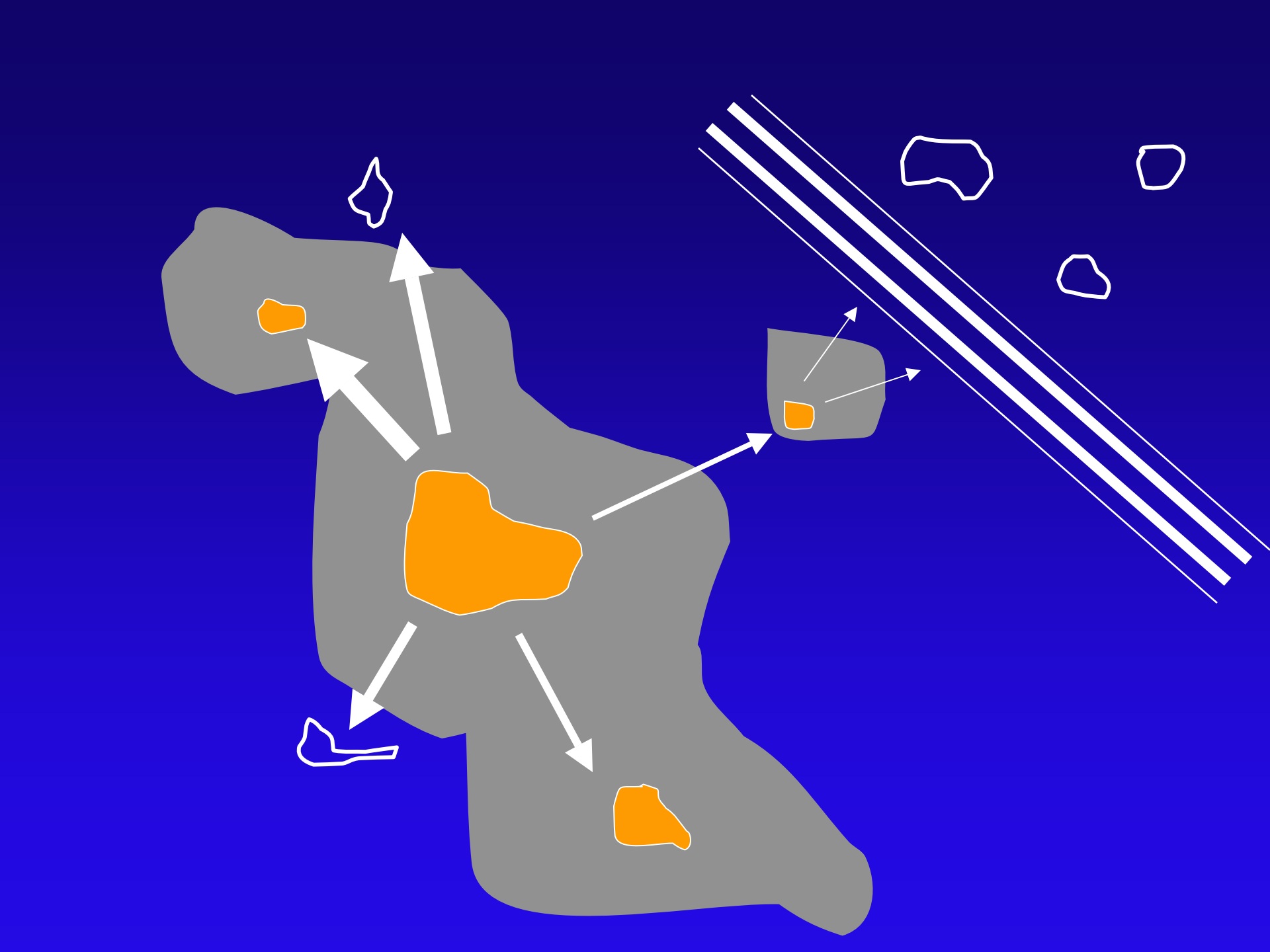






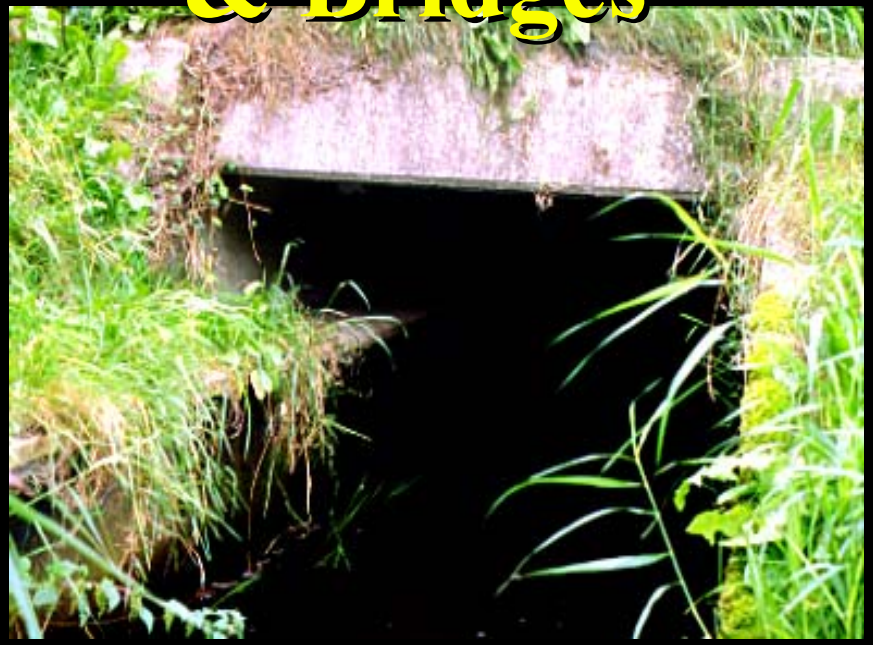






Drainage Culverts

Modified Culverts & Bridges



Drainage/Wildlife Culverts


Open-Bottom
Arch


Stream Simulation
Culvert

Expanded Bridges

Amphibian & Reptile Tunnels

Upland Culverts

Wildlife Bridges (Underpasses)

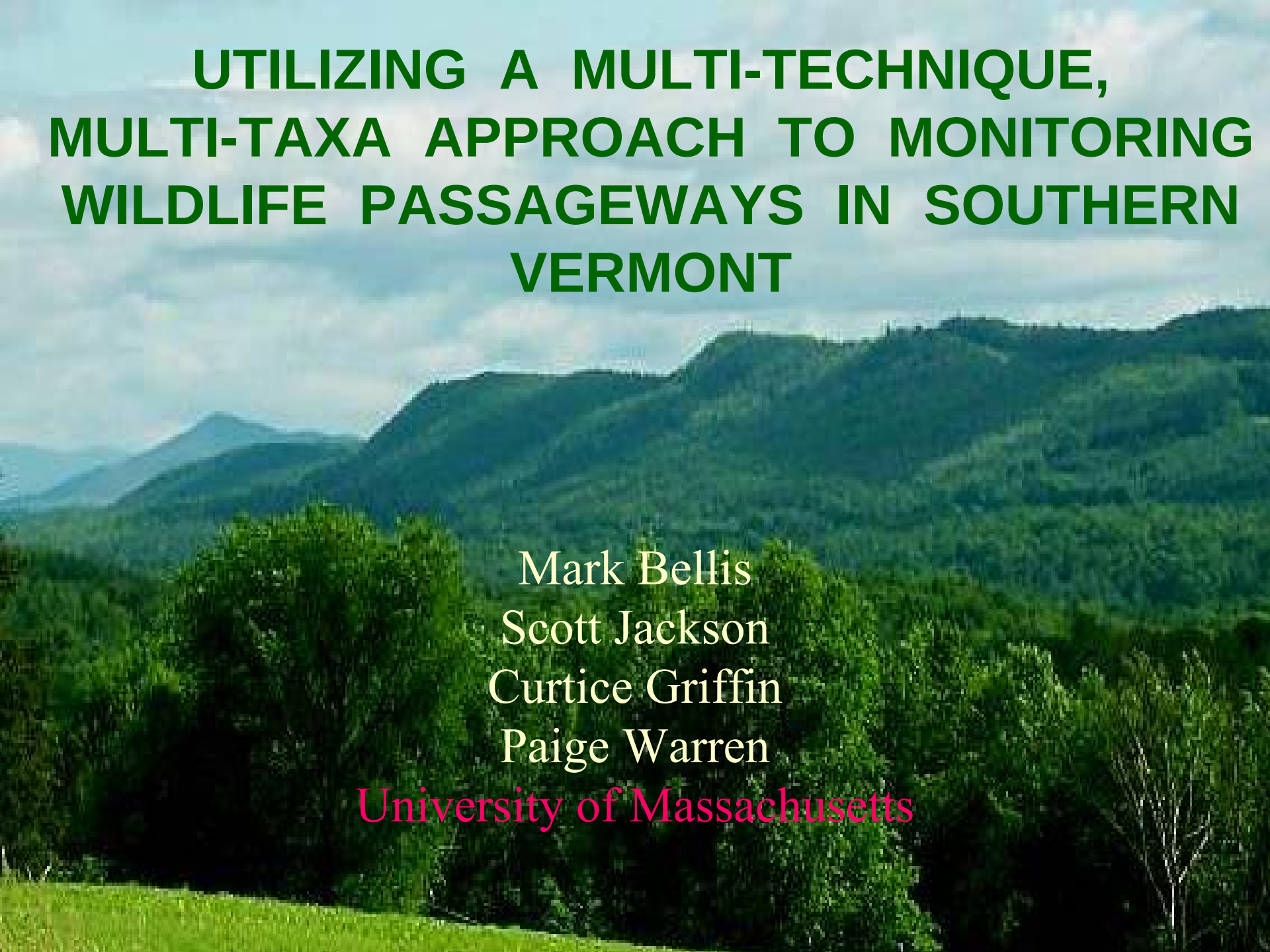
Overpasses (Ecoducts)

Viaducts & Tunnels

Factors Affecting Wildlife Use

- Placement
- Size/openness
- Light
- Moisture/hydrology
- Temperature
- Noise
- Substrate
- Approaches
- Fencing
- Human use

UTILIZING A MULTI-TECHNIQUE, MULTI-TAXA APPROACH TO MONITORING WILDLIFE PASSAGEWAYS IN SOUTHERN VERMONT



Mark Bellis
Scott Jackson
Curtice Griffin
Paige Warren
University of Massachusetts

Introduction

Monitoring wildlife passageways for effectiveness

Review of 21 studies reveals:

- Primary focus is passage usage
- Minimal research on non-use of passageways

- Emphasis on ungulates and large carnivores

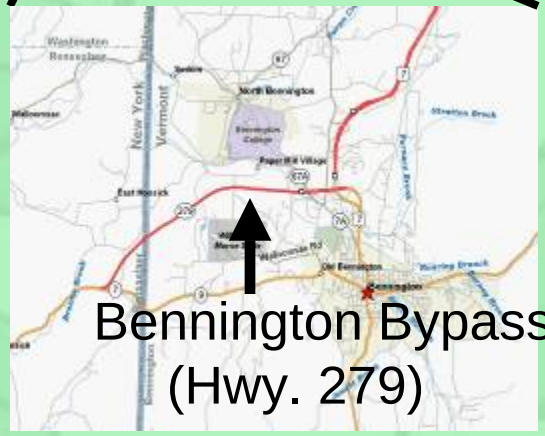
The Bennington Bypass Project

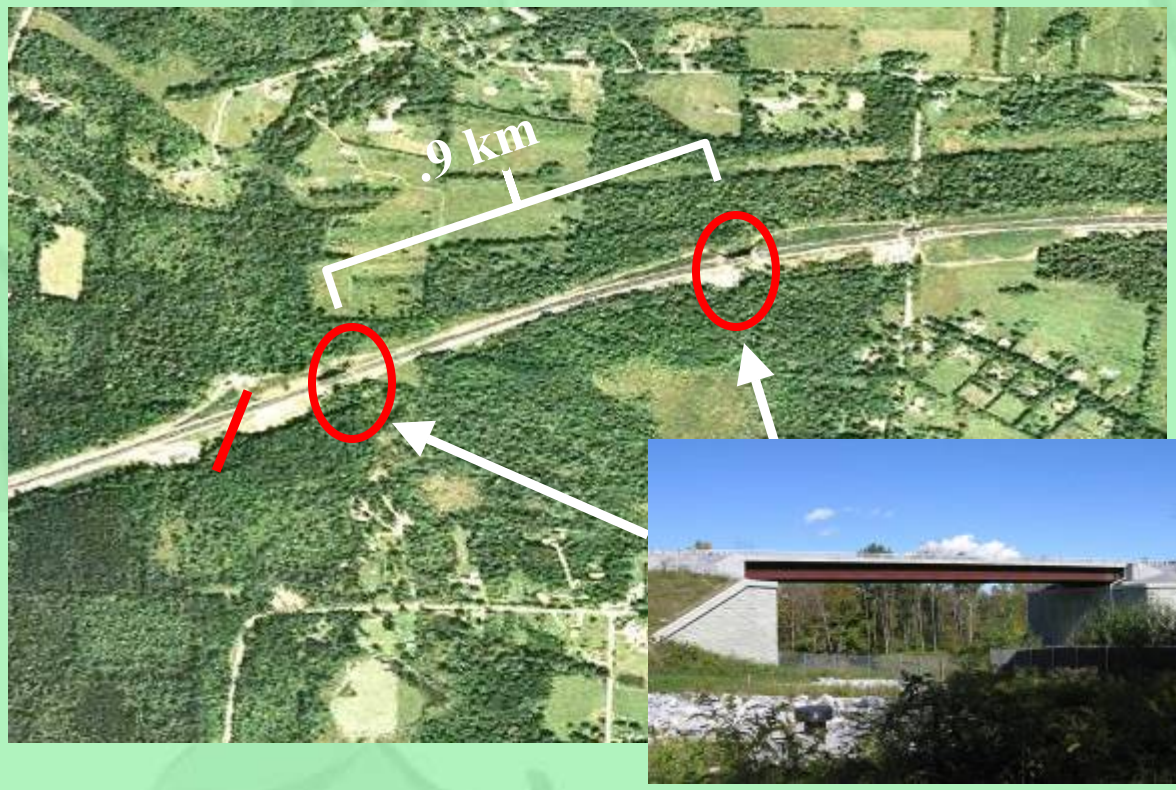
VTrans Working to Get You There
Vermont Agency of Transportation

VERMONT
FISH & WILDLIFE

- Evaluate effectiveness of passageways
- Test and refine monitoring techniques
- Develop protocols for future highway projects in Vermont and throughout the United States

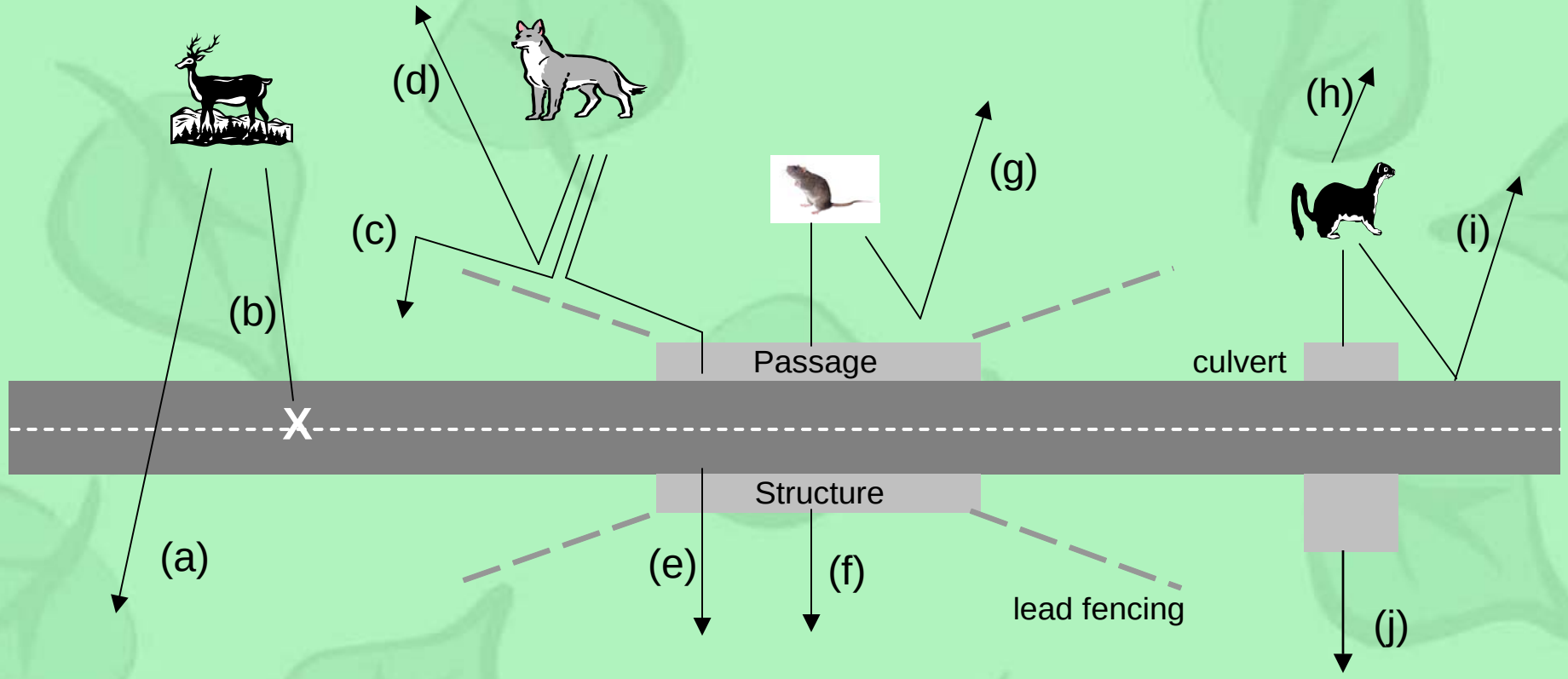
Study area





- Highway 279 – completed October 2004,
  7km long, 2 lanes w/passing lanes
- Three wildlife passageways –
  - Two underpasses ~ 50m span, 13m rise, streams flow through both
  - One round culvert -124m long,1.65m wide

Conceptual Model
for developing monitoring protocols
Defining potential wildlife movements



1) Passage avoidance

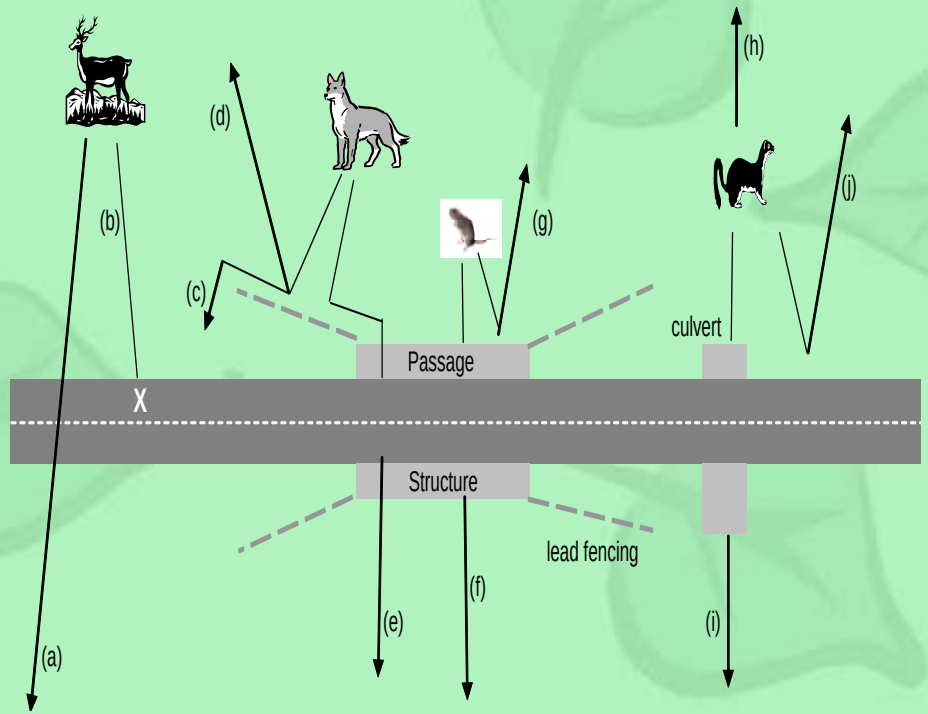
2) Road avoidance

3) Attempted road crossing

4) Successful passage crossing

Techniques matrix used to determine movements

Method	Taxa group	Movement monitored
Small mammal mark/recapture	Small mammals	a, e, f
Snowtracking	Medium and large mammals	a, b, c, d, e, f, g, i
Track beds/plates	All	e, f
Remote cameras	Medium & large mammals	a, c, e, f
Roadside track beds	Medium & large mammals	a, b, i
Road kill surveys	All	b
Amphibian recording devices	Frogs & toads	n/a



Discussion

Evaluating Effectiveness

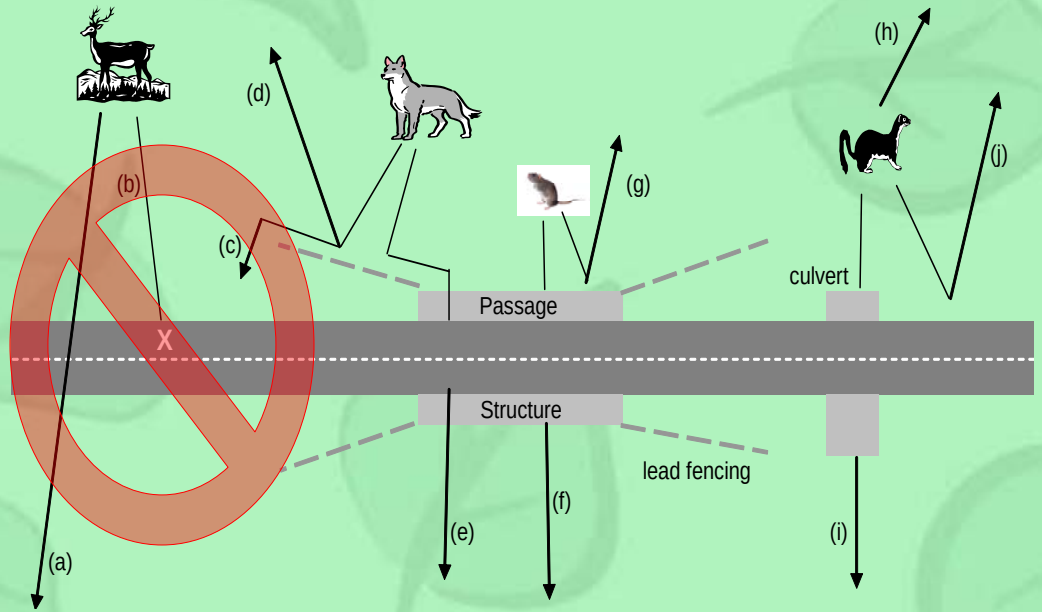
Defining Objectives for Connectivity

Population Objective	Wildlife Movement Objective
Reduce or avoid roadkill mortality	Effective barriers are more important than passage
Access to vital habitats	Passage for all or most animals
Population continuity	Passage for enough individuals to maintain a cohesive gene pool
Metapopulation dynamics	Occasional passage for a small number of individuals, perhaps juveniles

Developing metrics and establishing criteria for success

1) Define objectives

Example: Objective is to increase public safety



2) Use Model to establish metric

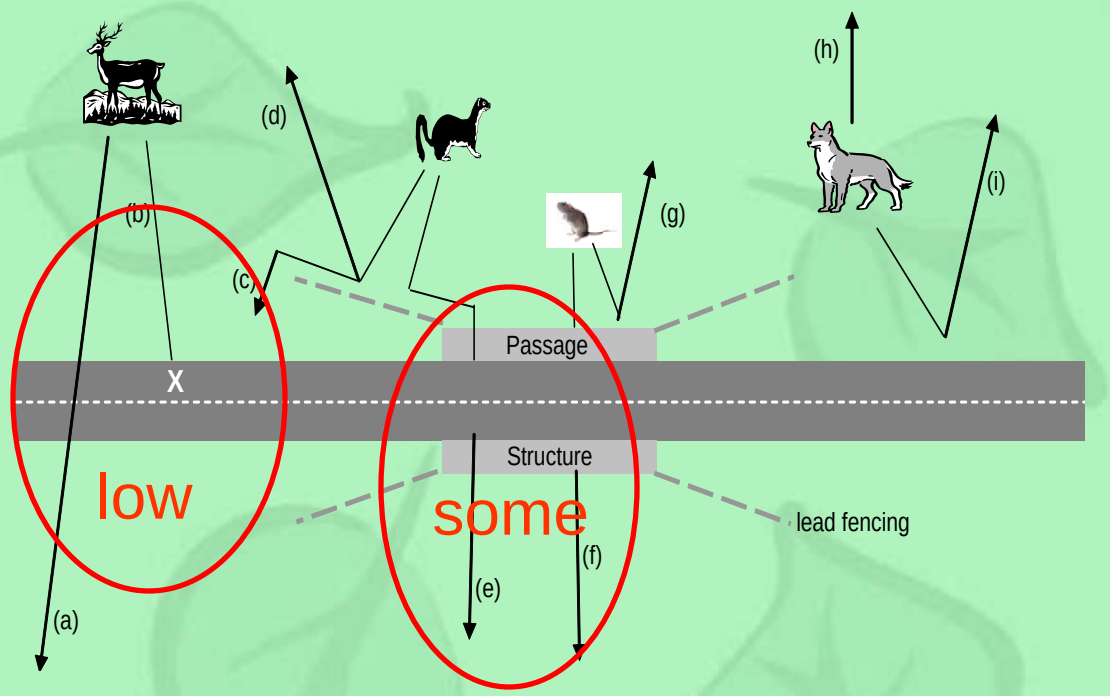
Agency would want low number of attempted road crossings

$\sum$ **(a,b,c)**

Example 2

Objective: reduce animal collisions and allow a degree of movement through the area

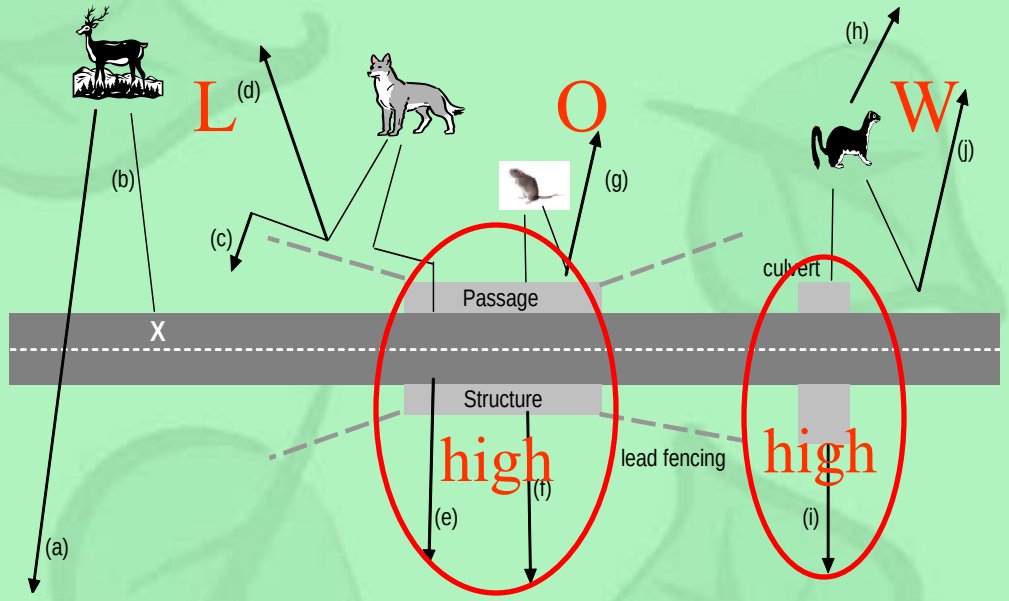
$$\frac{\sum (e,f)}{\sum (a,b,c)}$$



Example 3

- Objective: Prevent roadkill and provide access to vital habitats (e.g. - Blanding's turtle – *Emydoidea blandingii*)

$$\frac{\sum(e, f, i)}{\sum(a\text{-}d, g, h, j)}$$

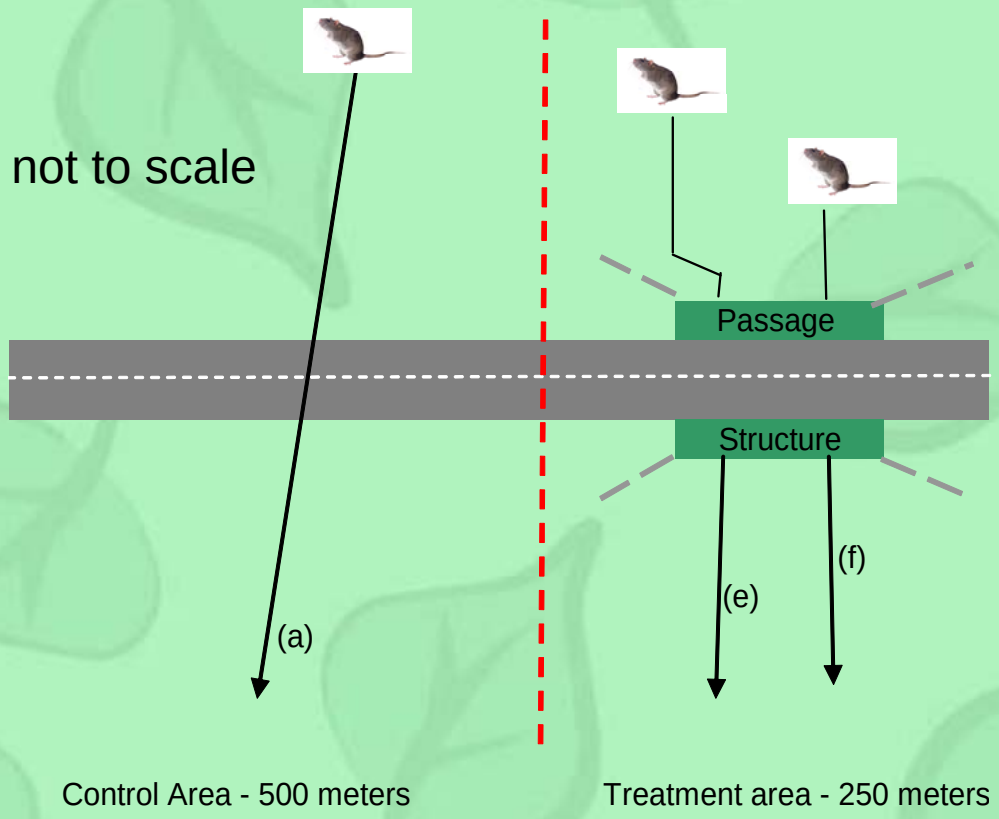


Study Design

Small mammal movements

Four – 750m long transects, 50m apart

- traps spaced 25m apart
- four “quadrants”



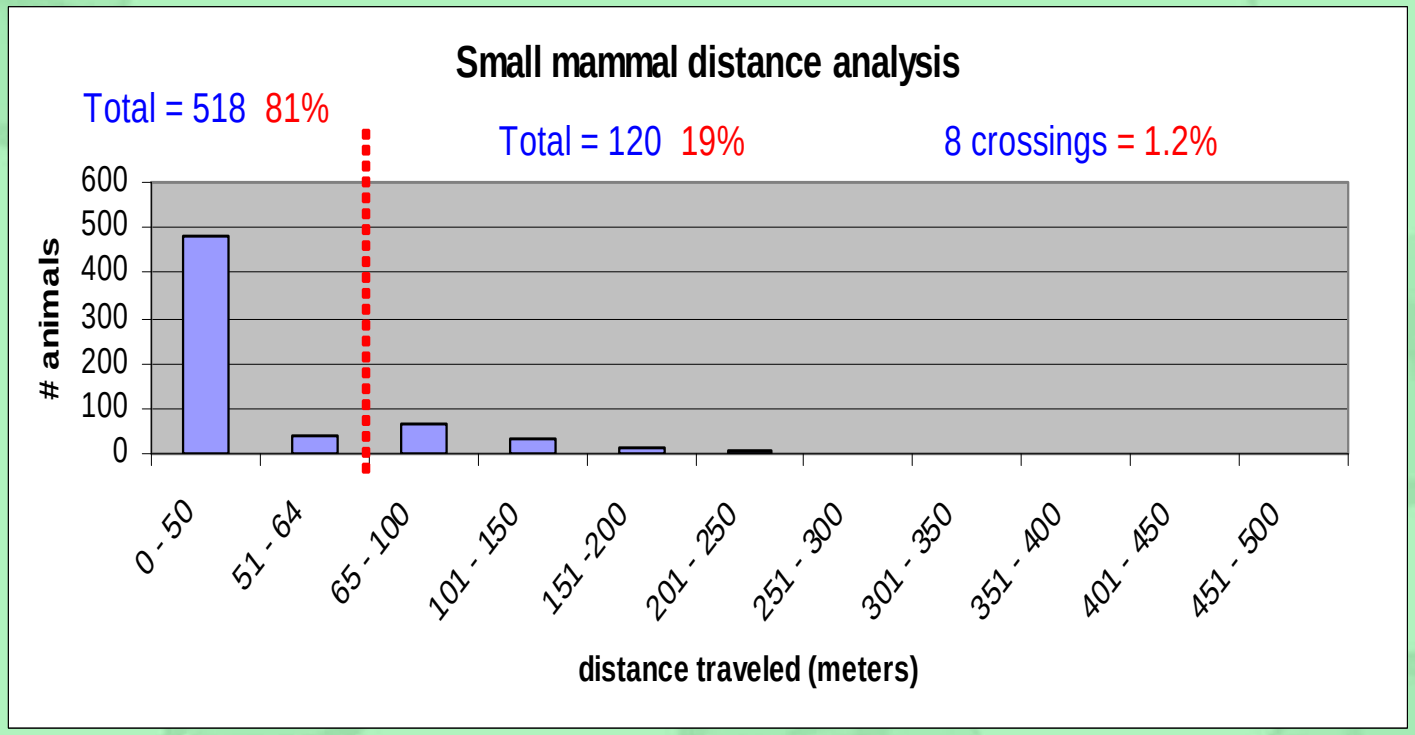
- Determine if small mammals are crossing passageways in similar proportion to their average movements in the natural habitat

Small Mammal Trapping (cont'd)

- 16 weeks of trapping
- 418 tagged animals
- 638 recaptures

Species: *white footed mouse*
deer mouse, red-backed vole,
meadow vole, eastern chipmunk

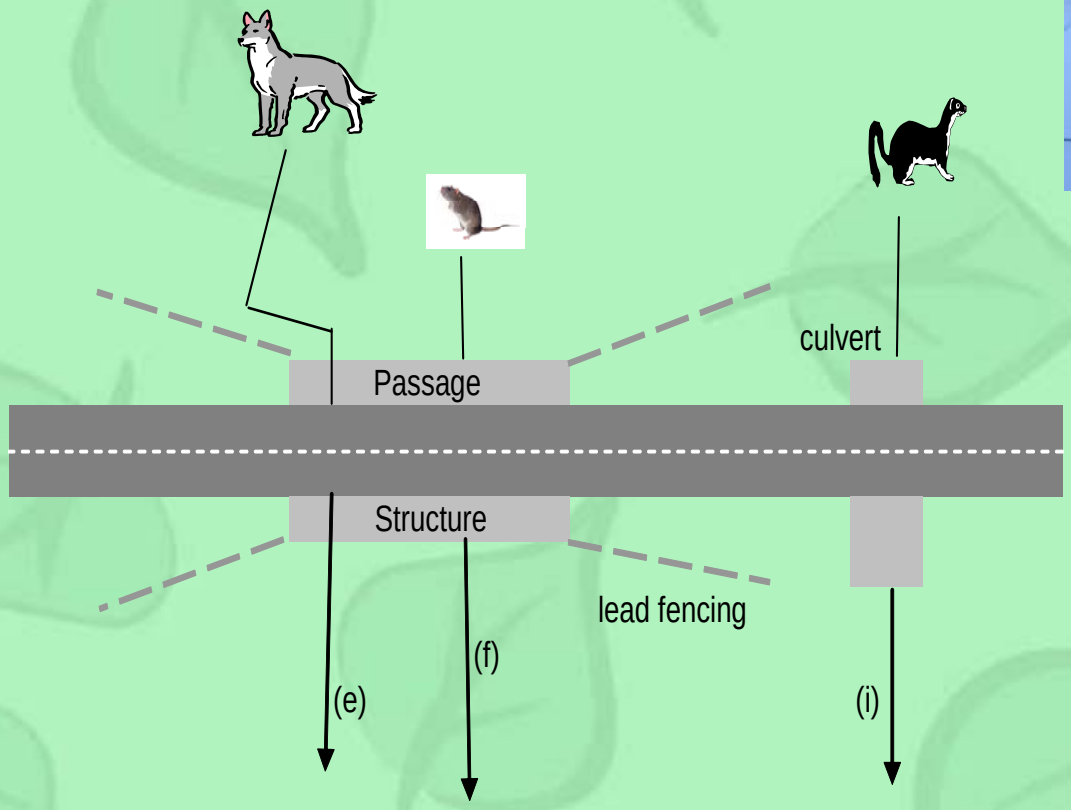
- Species trapped, not tagged: long-tailed weasel, northern short-tailed shrew, red squirrel and meadow jumping mouse



Monitoring of Mitigation Structures

- Document species utilizing passageways and culvert

Marble dust track beds



Sooted track plates

Track Bed Data

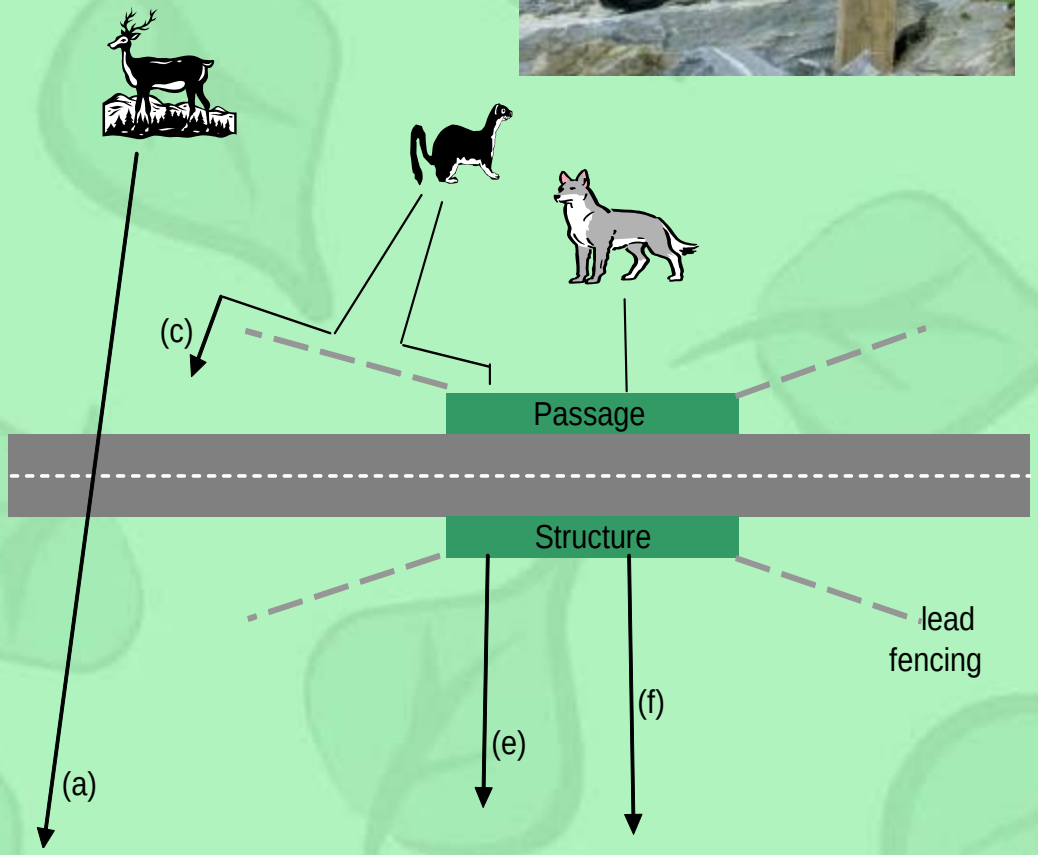
Species	Total	West Airport	East Airport
Woodchuck	93	58	35
White tailed deer	34	34	0
Domestic cat	33	2	31
Wild Turkey	20	1	19
Raccoon	19	11	8
Opossum	12	12	0
Gray squirrel	11	6	5
Eastern cottontail	11	3	8
Bobcat	5	3	2
Coyote	2	1	1
Mink	2	1	1
Eastern chipmunk	2	0	2
Ermine	1	1	0
Muskrat	1	1	0
Striped skunk	1	0	1

Culvert Track Plates

- Seventeen surveys
- Species usage; ermine – 17, mink - 6, raccoon – 3 and woodchuck - 1

Key finding - ermine appear to prefer the cover offered by the culvert versus the passageways

Remote cameras



- Use of both infrared digital (Reconyx) and various 35mm
- Record animal movement not captured by track beds
- Monitor non-passageway movements
- Capture crossings at right of way/wildlife fencing transition areas

Digital images

35mm images


2006-05-23 07:16:57 M 1/10 8°C
WWW.RECONYX.COM


2006-05-23 07:16:58 M 2/10 8°C
WWW.RECONYX.COM


2007-07-19 12:31:56 PM M 1/10 72°F
WWW.RECONYX.COM


2007-07-19 12:31:56 PM M 2/10 72°F
WWW.RECONYX.COM


2007-07-19 12:31:57 PM M 3/10 72°F
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2007-07-19 12:31:57 PM M 4/10 72°F
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2007-07-19 12:31:59 PM M 7/10 72°F
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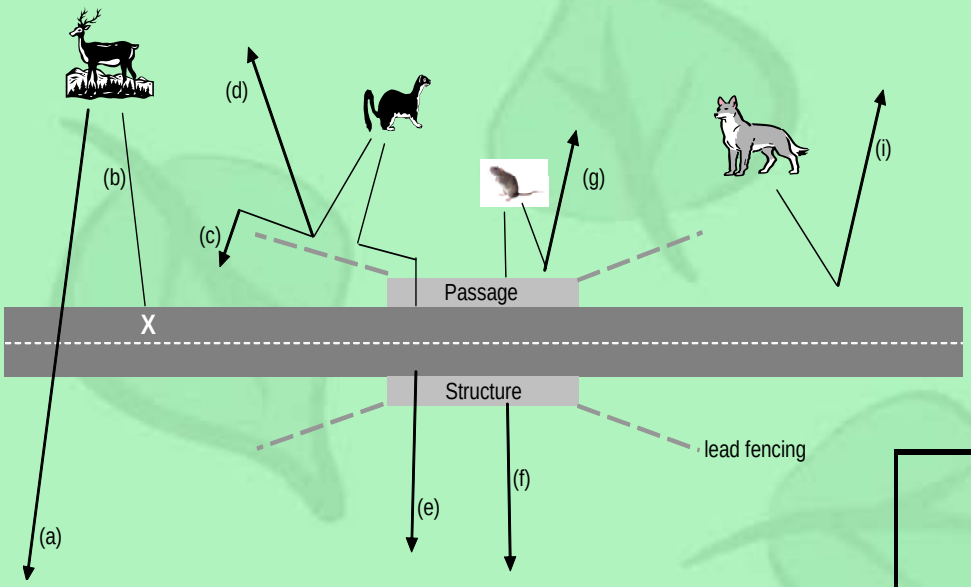
2007-07-19 12:31:59 PM M 8/10 72°F
WWW.RECONYX.COM

Remote cameras (cont'd)

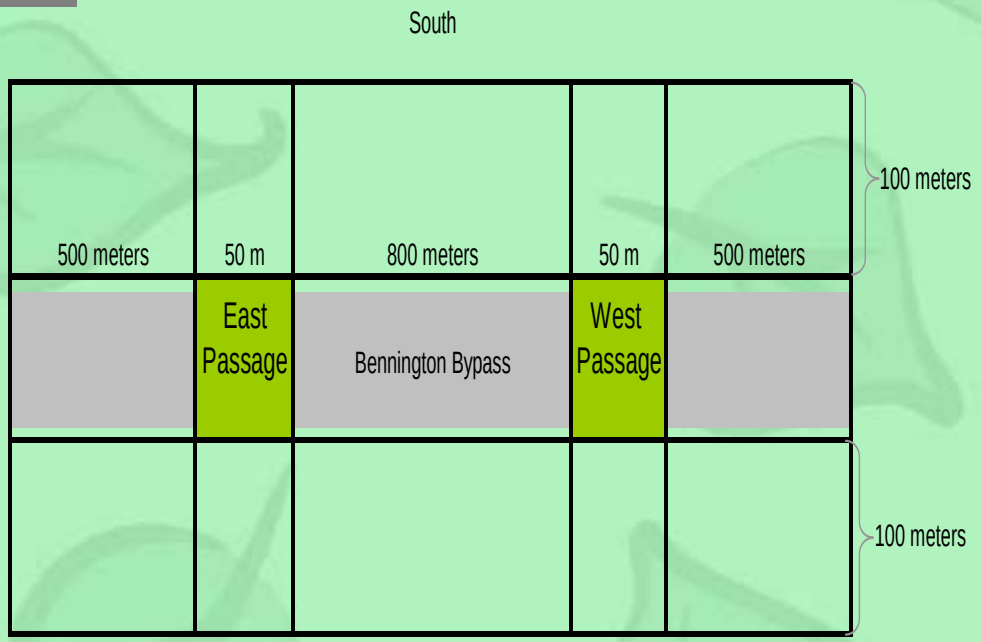
- Key findings
  - Confirm high usage of two non-passage wildlife corridors
  - Stream beds used moderately for passageway crossing
  - Deer avoid track beds but pass through the passageway nonetheless
  - Shady characters persist in our study area
- Modifications – expand monitoring to include fencing transition areas

Snow tracking

Assess animal movements throughout entire study area

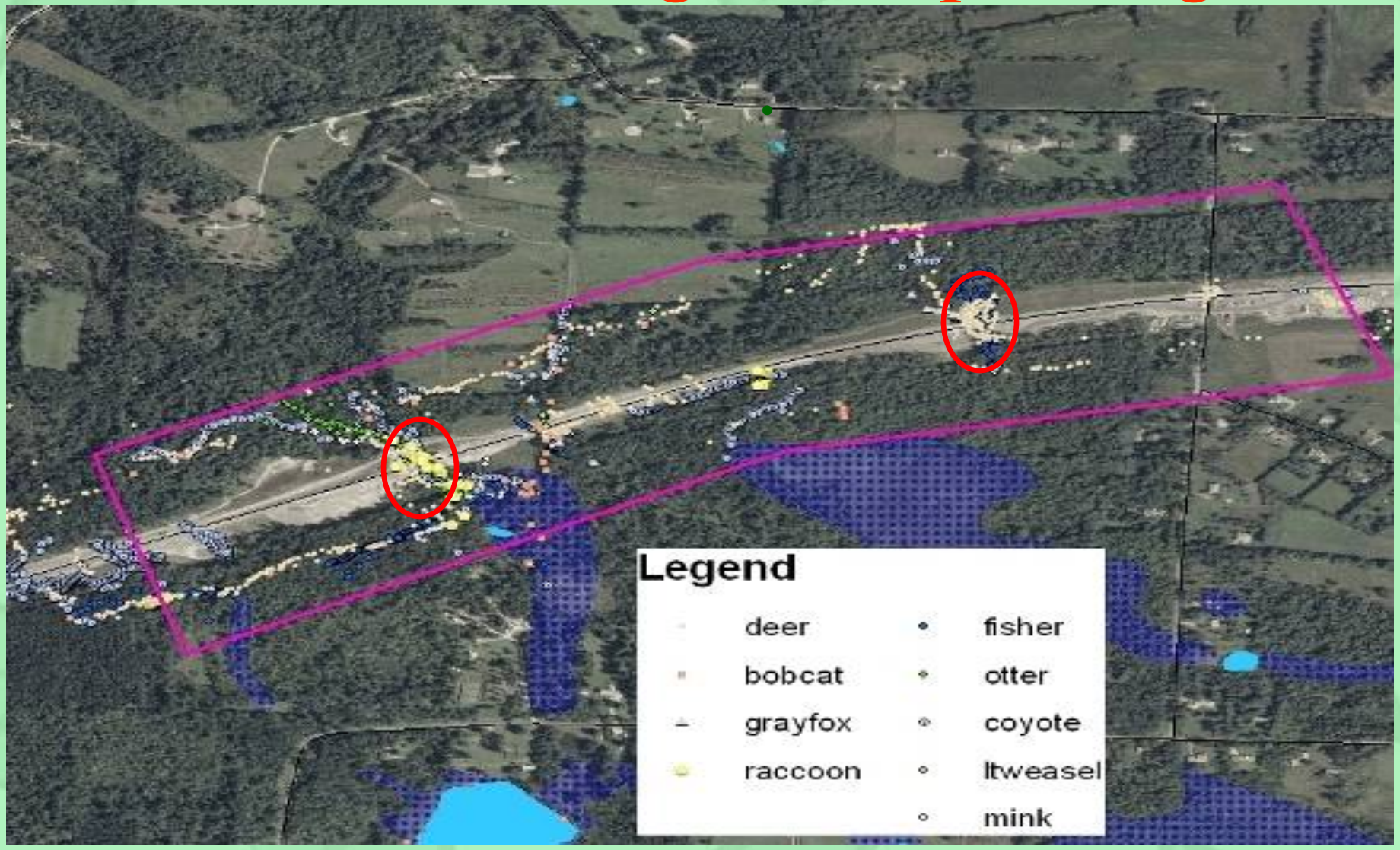


- Surveys conducted 48 hours after snowfall of ½" or more
- Use Cybertracker software for recording GPS points



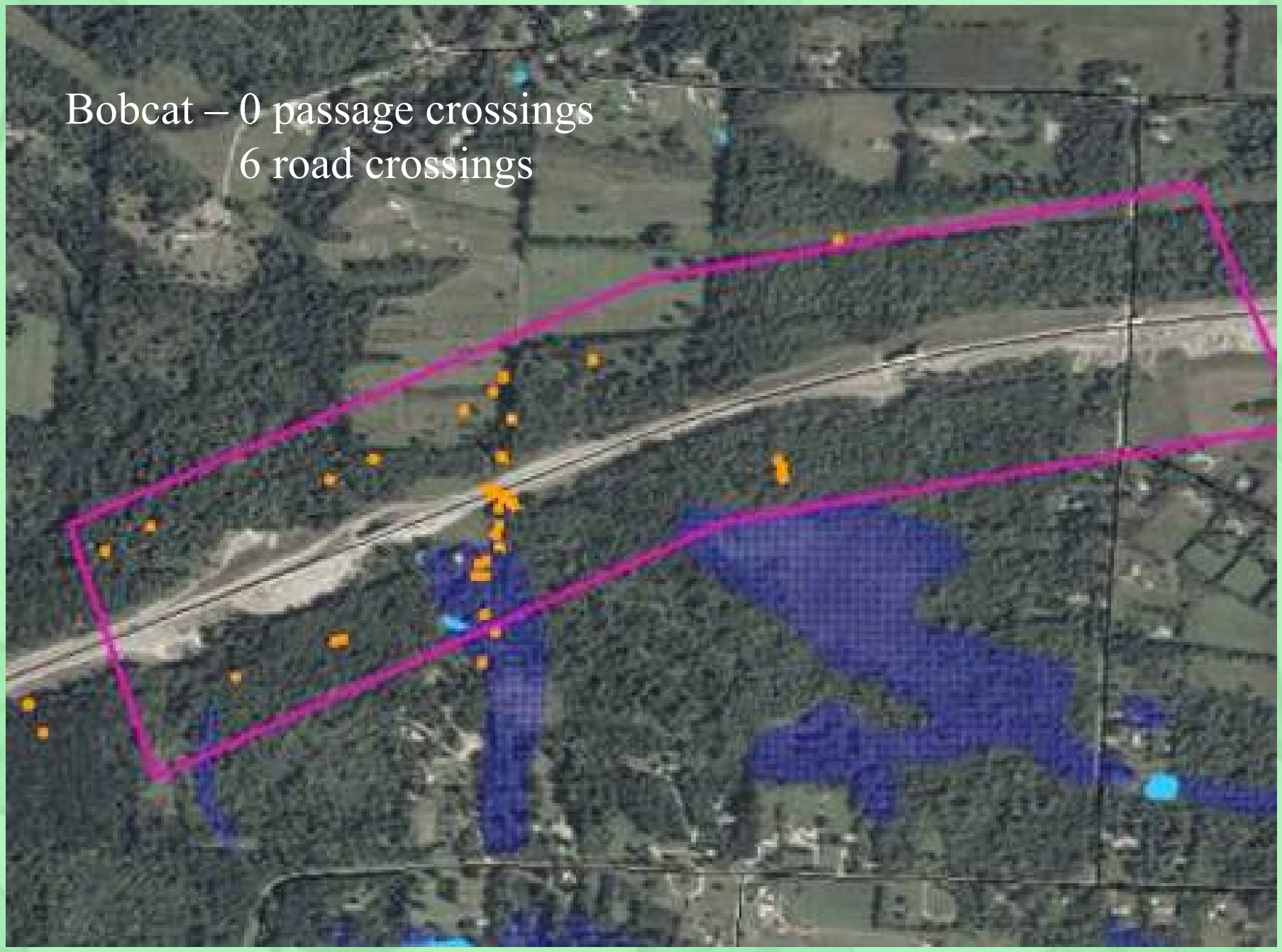
Tracking grid

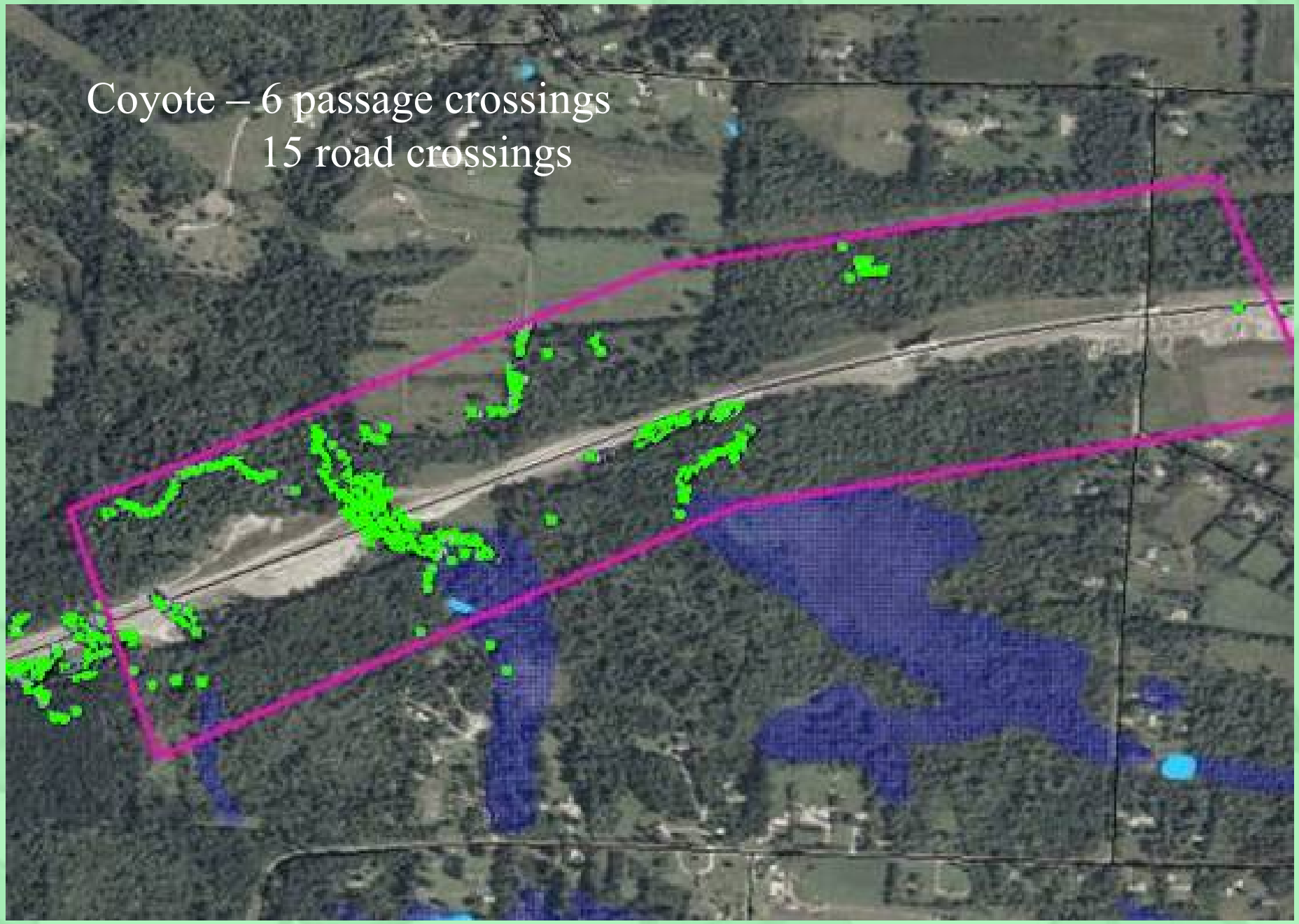
Snow tracking - GIS plotting

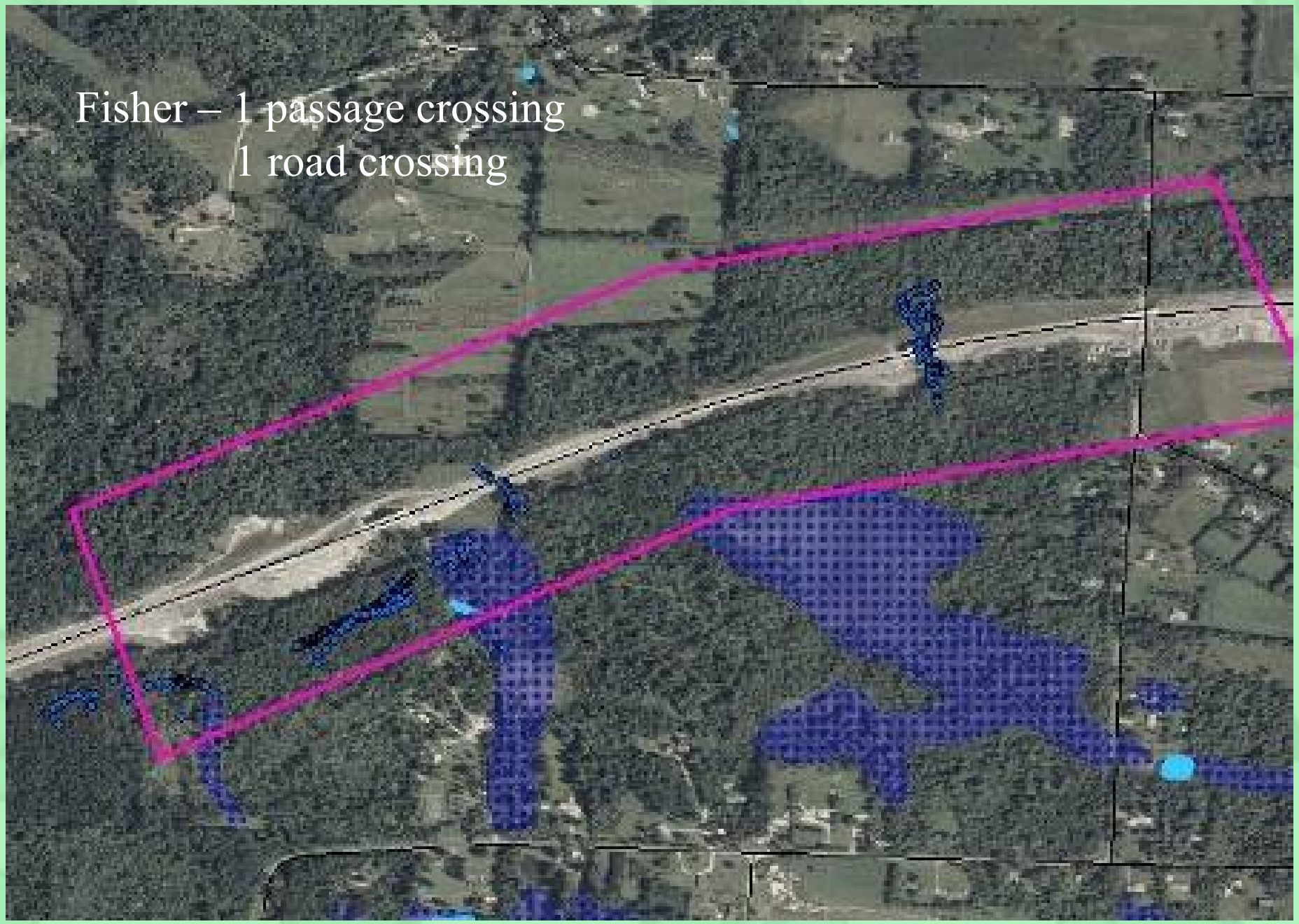


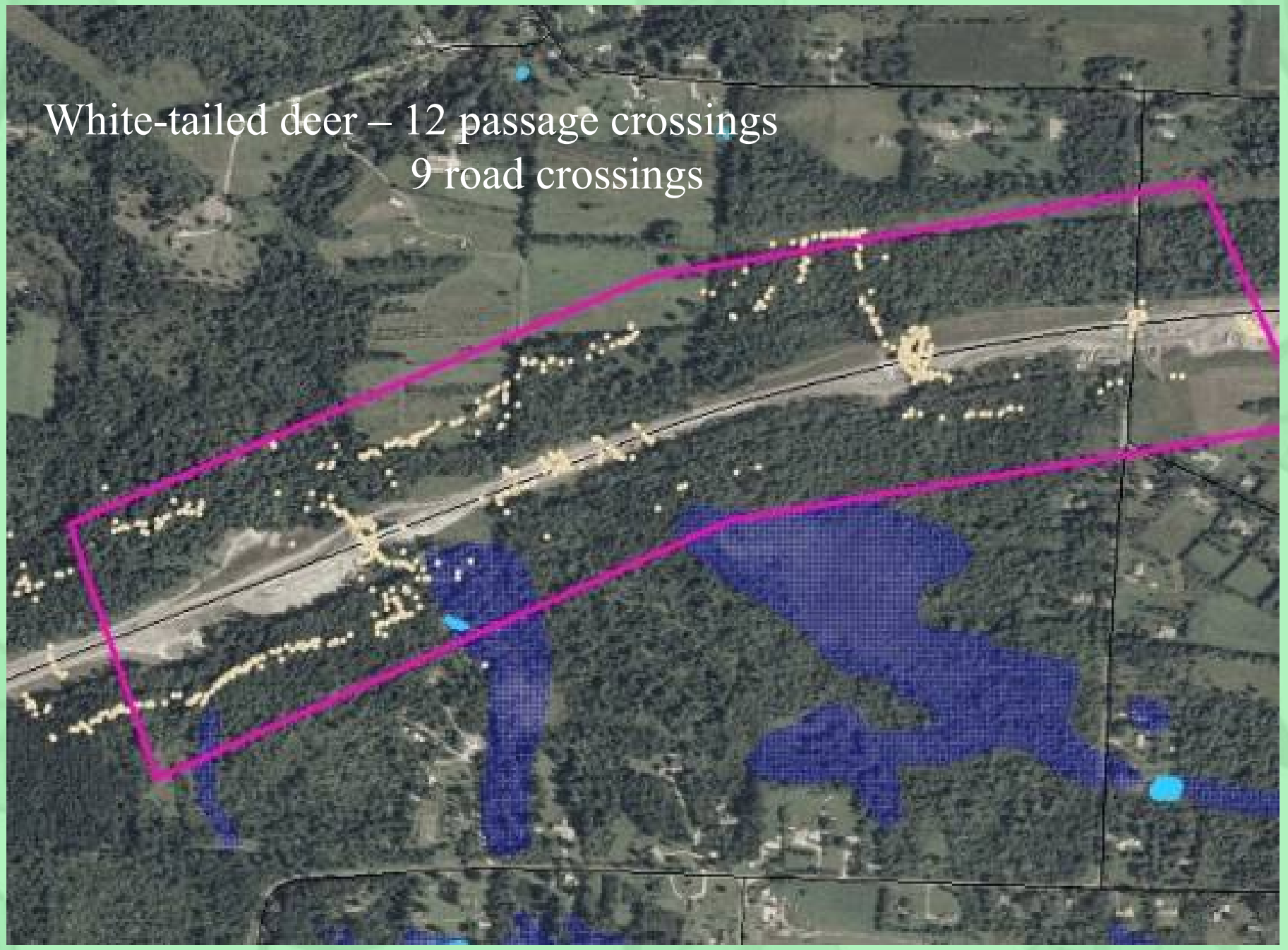
Two heavily used non-passage crossing areas detected

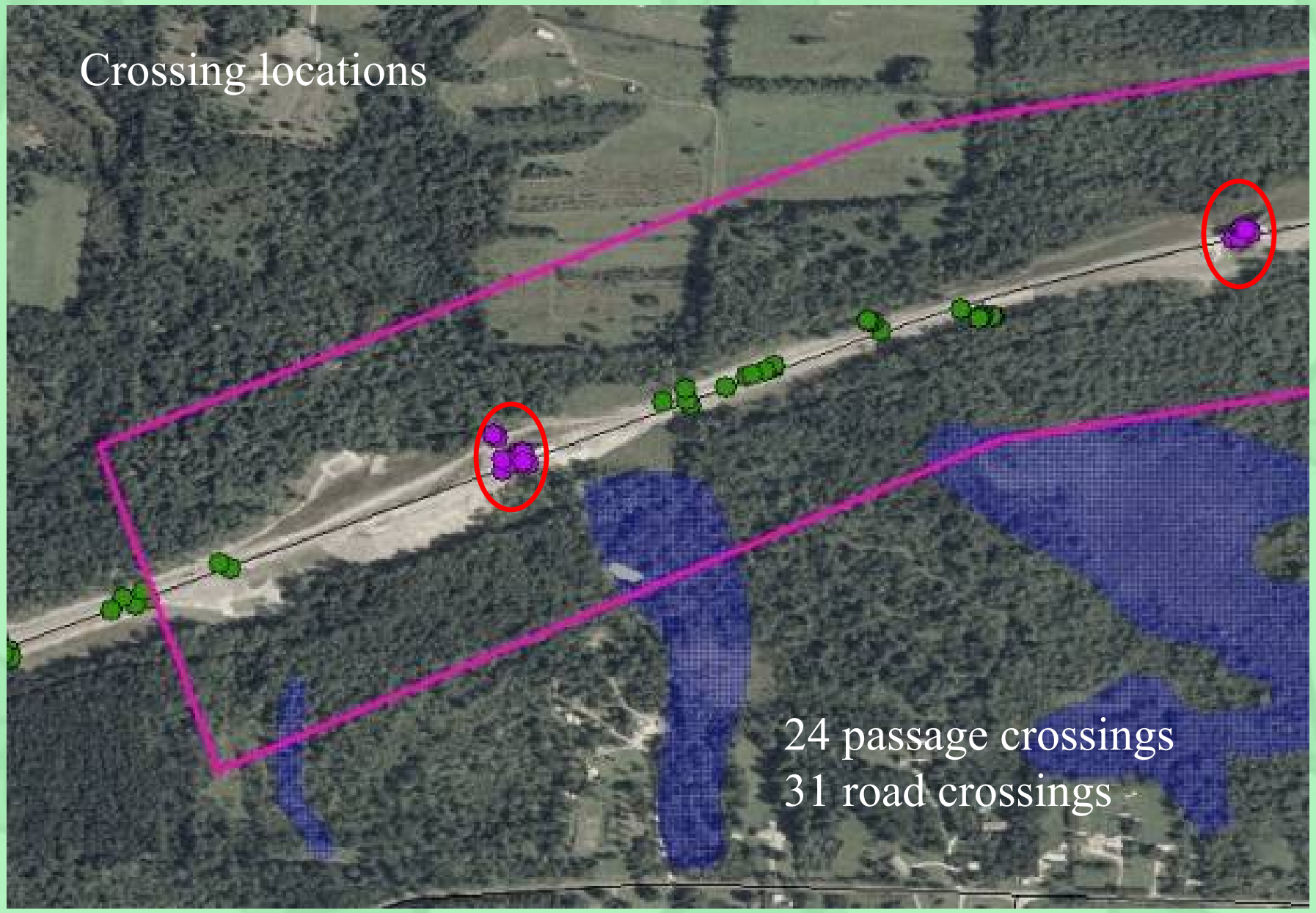
Pre construction data IMPORTANT!!


Bobcat – 0 passage crossings
6 road crossings


Coyote – 6 passage crossings
15 road crossings


Fisher – 1 passage crossing
1 road crossing

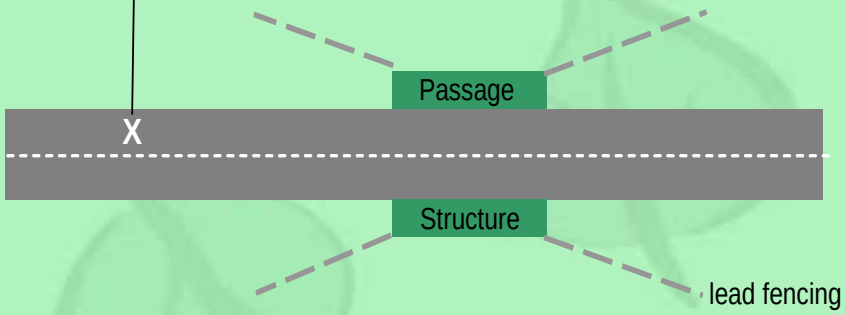

White-tailed deer – 12 passage crossings
9 road crossings



Reinforces importance of fencing

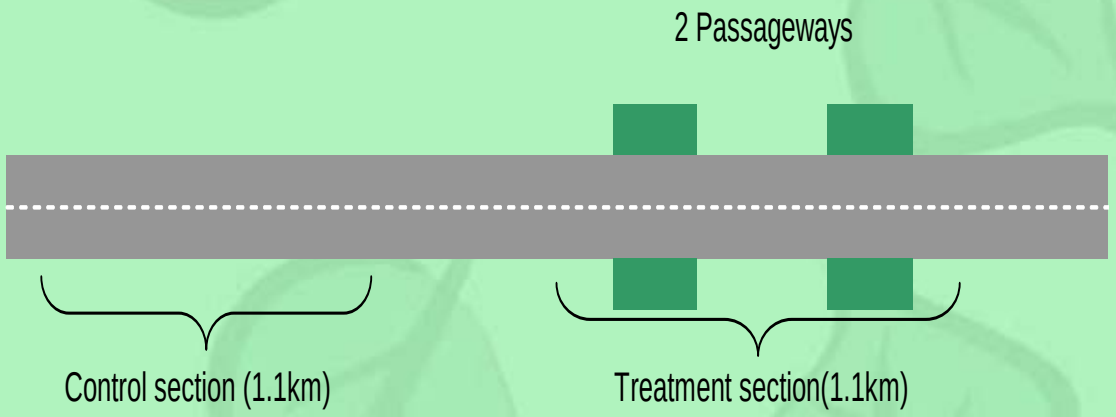
Road kill surveys

- Entire 7km of highway is surveyed 3 times a week



Preliminary results: – no statistical difference in road kills, control vs. treatment
- road kill does not change at varying distances from passage structures

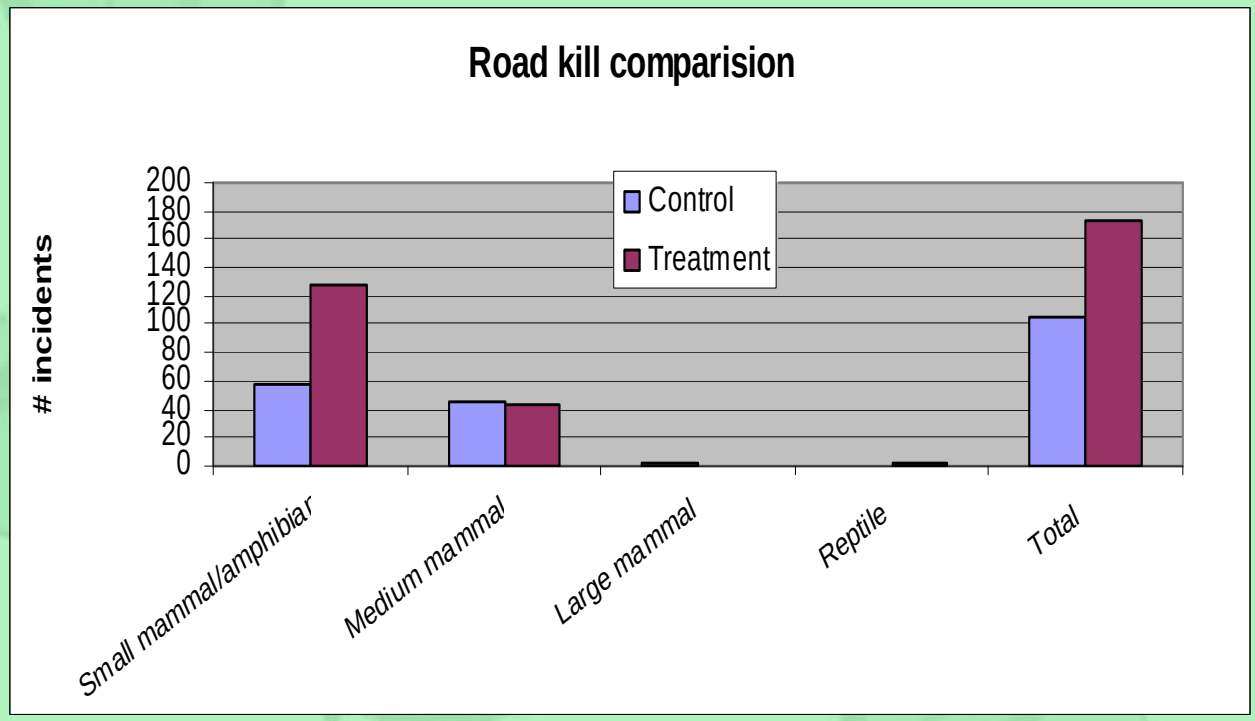
- Compare road kill, control vs. treatment section
- Compare road kill numbers at various distances from passageways



Road kill surveys (cont'd)

- Surveys conducted three times per week
- Sixty six surveys conducted

Hypothesis – Road kill rates will be higher on the control (unmitigated) portion of the highway

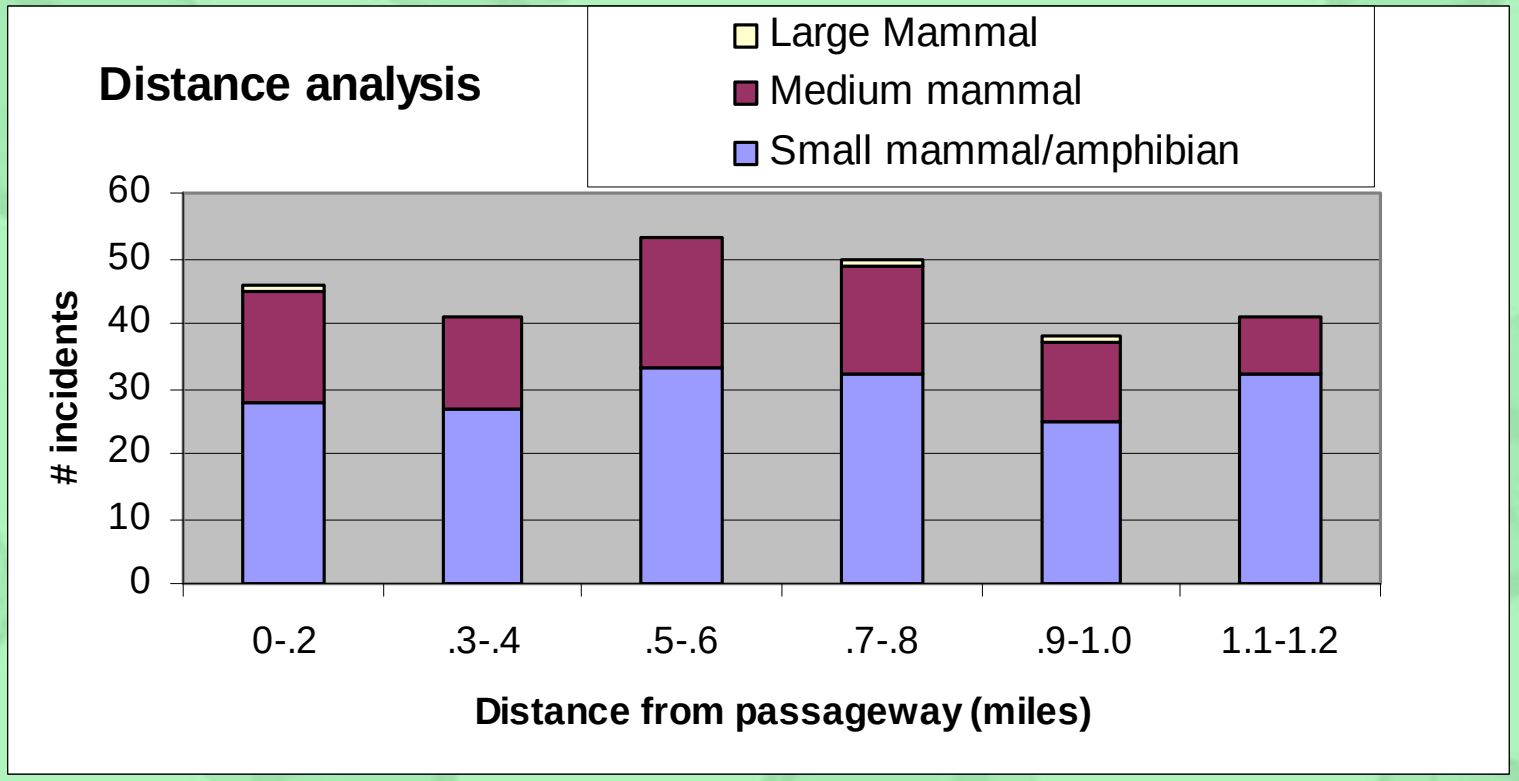


Treatment - 1.2 mile section containing both passage structures

Control – 1.2 mile section on west end of Bennington Bypass

Road kill surveys (cont'd)

Hypothesis: Road kill rates will increase at distances further from the passage structures



Roadside track beds

- Constructed 2 pairs of 30m x 1m track beds alongside highway at random locations
- Used to monitor successful highway crossings

Frogloggers

Amphibian recording devices used to evaluate impacts of highways by noting changes in amphibian populations over time

Conclusions

Bennington Bypass study:

1. Provides useful tools in designing monitoring protocols
2. Provides broader landscape level approach to monitoring
3. Allows more rigorous evaluation of mitigation effectiveness

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